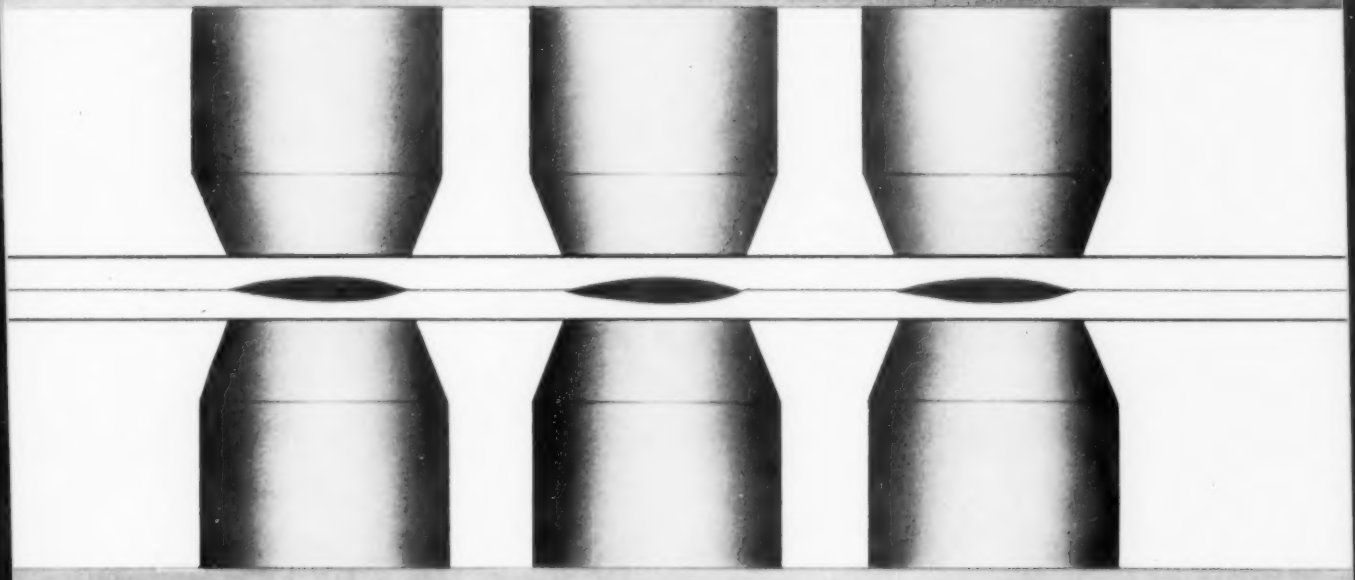
THE tool engineer

JUNE 1957



spot welding

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Heald announces TWO NEW DEVELOPMENTS

THE NEW "RITE-ANGLE" CENTRI-MATIC

Clifford G. Menard
Chief Engineer,
Grinding Division

ANY new development that can cut grinding time by up to 50 per cent is important news. And since our new RITE-ANGLE Centri-Matic internals will do just that, some inside information on how this rather startling improvement was brought about may be of interest.

In order to permit heavier feeds and faster stock removal, we have *inclined* the wheelhead table at a 30 degree angle – to oppose feeding and grinding forces to best advantage.

With this new RITE-ANGLE construction, stock can now be removed at the rate of two cubic inches per minute without any distortion or unwanted movement of the table, keeping the wheel properly buried in the work. This compares to a previous maximum stock removal of about 1 cubic inch per minute.

The Model 190A and 1901A Centri-Matics utilize a new cycle and compensating diamond arrangement, especially designed to take full advantage of the faster feeds and automatically maintain optimum grinding intervals under varying conditions of work size and stock removal. Spindle pressure against the work during all portions of the grinding cycle is measured by an ammeter on the control panel, permitting proper roughing and finishing pressures to be established during the set up. The feed box controls will automatically maintain these pressures during the production cycle.

The RITE-ANGLE design can be likened to an iron hand in a velvet glove – giving greater strength where strength is needed, yet retaining the extremely high precision that is so essential to bearing race work.

THE NEW "UNIT-TYPE" BORE-MATIC

John J. McCabe
Chief Engineer,
Bore-Matic Division

THE unitized or "building-block" design has been applied to large automated machine tool equipment with considerable success. And now, with the development of the new Model 0 Unit-Type Bore-Matic, we have applied this same basic principle to a small, individual machine, with some very interesting results.

Designed around a number of standard, interchangeable units or "building blocks," the Model 0 is actually many machines in one – providing far greater versatility and economy than have ever before been available in a high-precision machine of this type. It can be arranged as a single or double end machine, with one or two boringheads or a multi-spindle unit at either or both ends. Hence it puts custom-built machine design on an "off-the-shelf" basis, meeting the exact requirements of any small-work Borizing job.

One of the outstanding features of this machine is a new MULTI-SPINDLE Boringhead that offers the first practical solution to the problem of Borizing multiple holes on close centers. Heretofore this has had to be done, one hole at a time, on large, costly equipment requiring high operator skill. But with the new MULTI-SPINDLE head, any practical number of holes, with centers as close as ¾", can be Borized simultaneously and duplicated again and again with extremely high accuracy. Individual Red Head boringhead spindle units are mounted in interchangeable spindle plates, jig bored to the requirements of each job. This completely flexible clusterhead arrangement puts multi-hole, close-center Borizing on a low cost, production basis.

THE HEALD MACHINE COMPANY • Subsidiary of The Cincinnati Milling Machine Co. • **Worcester 6, Massachusetts**

For further details see Pages 4 and 5

COVER: Multiple spot welding methods are a frequent choice for fastening sheet metal assemblies. The article "Automated Spot Welding Machine Improves Productivity and Quality," beginning on page 103, shows how one group of tool engineers developed a high-production method for welding coaster wagon wheels.

the tool engineer

The Tool Engineer

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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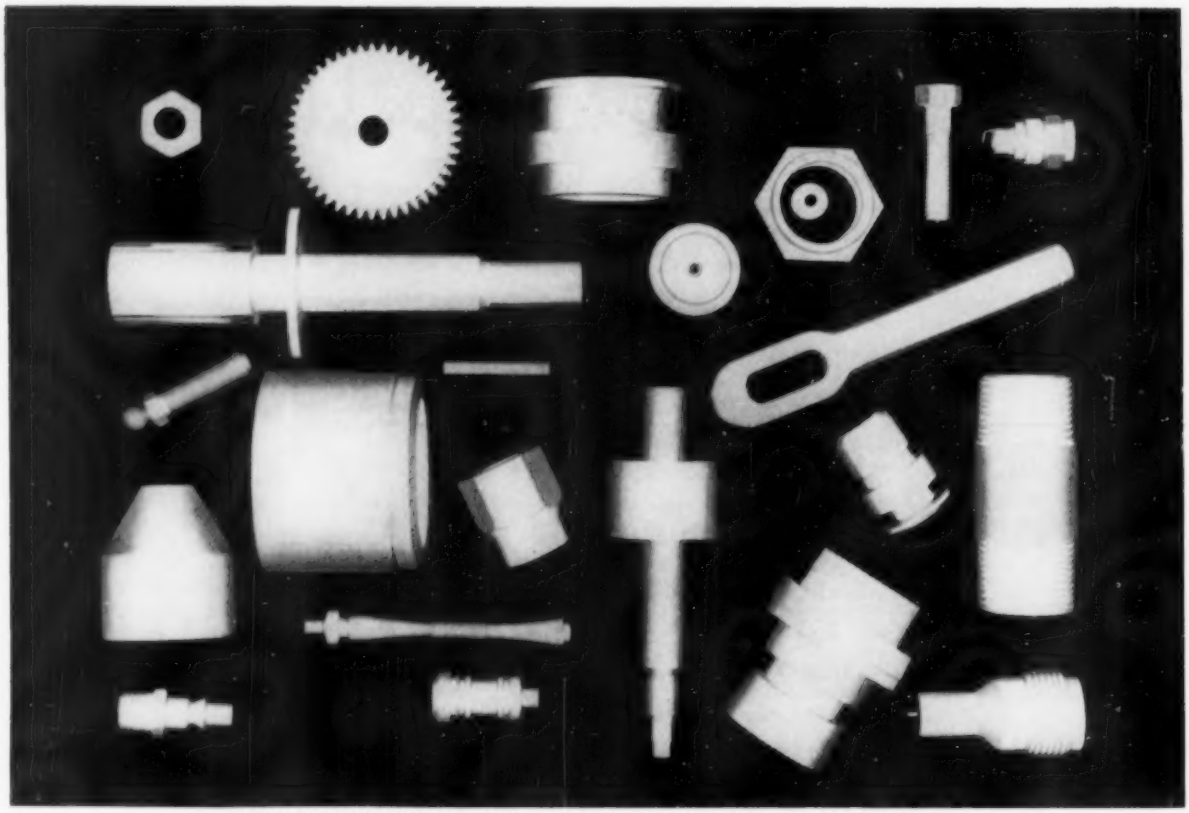

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The Tool Engineer

Brainstorming

Lately, there have been many articles on brainstorming in engineering journals. Briefly, the theory behind brainstorming is that there's lots of latent creative talent in everybody. One way to bring it out is to get a group of people around a table, give them a specific problem to discuss, and tell them to come up with new ways of solving the problem.

"Negative thinking" is discouraged; the objective is to get as many ideas as possible down on paper. These ideas are evaluated later.

Tool engineering is—by definition—a creative profession and we are heartily in favor of any method for finding effective solutions to manufacturing problems. New ideas are the lifeblood of any business and may be the key to survival in a competitive economy.

These ideas—to mean anything—must be translated into production reality. Progress, after all, can be measured only in terms of accomplishment. Accomplishment is nothing more than ideas in action.

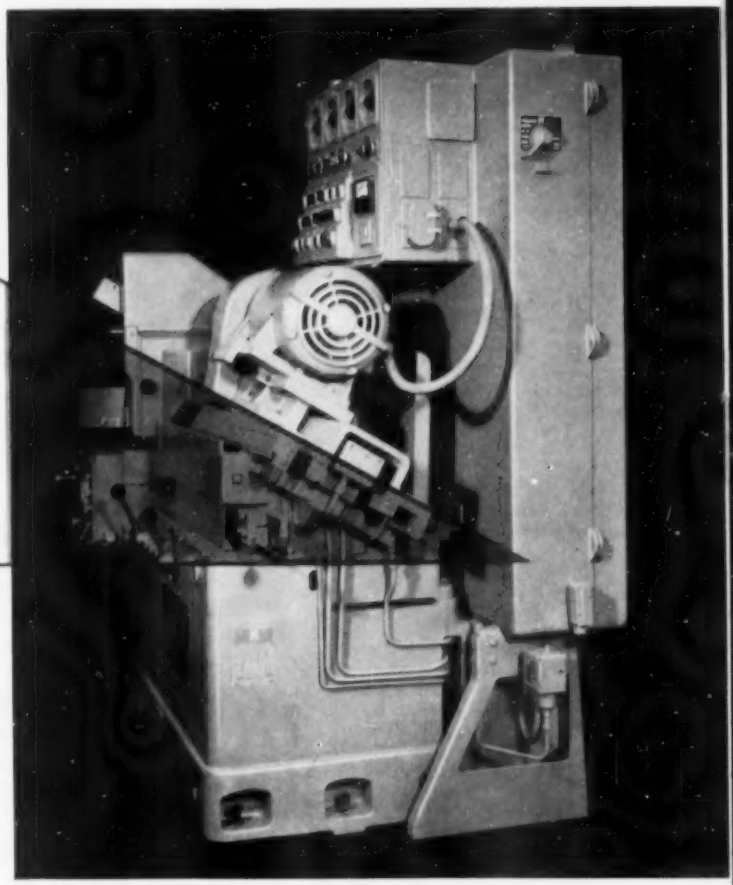
The best stimulus to the creativity of a tool engineer is to see his ideas take shape in the form of machines and tools. "Positive thinking" by management, where new ideas are concerned, is the only profitable kind of thinking. Creative thinking—today—means a more productive tomorrow.

Theodore W Black

ASSOCIATE EDITOR

New RITE-ANGLE CENTRI-MATIC

cuts grinding time as much as 50%



A NEW ANGLE in internal grinding gives greater strength and rigidity for faster stock removal, with highest accuracy and precision

The Heald RITE-ANGLE Centri-Matic represents the latest and most advanced design in the field of high-precision internal grinding. It includes all the basic advantages of other Heald internals — plus the added feature of substantially increased production rates. Mounting the wheelhead table at a 30° angle provides greater strength and stability and permits much faster stock removal.

Production economies due to faster grinding cycles are improved in all sizes of work handled on this equipment, but are most apparent in the larger (up to 4½" O. D.) sizes, where grinding time can be reduced as much as 50%.

This new RITE-ANGLE design is now available in the Model 190A Centri-Matic for straight and taper bores, and the Model 1901A Centri-Matic ball track grinder — both machines providing a new high in production, with maximum accuracy and precision, for work up to 4½" O. D. Ask your Heald representative for complete information or send for a copy of new RITE-ANGLE Bulletin.

OTHER ADVANTAGES

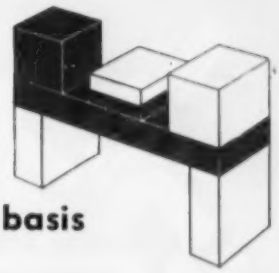
- Choice of Hi-Frequency or Belt-Driven Wheelheads
- Vee-Way Accuracy of Alignment with hardened and ground box-type table ways
- More Efficient Swarf and Coolant Disposal
- Infinitely Variable Hydraulic Cycles
- Automatic Feed Control with Self-Adjusting Diamond

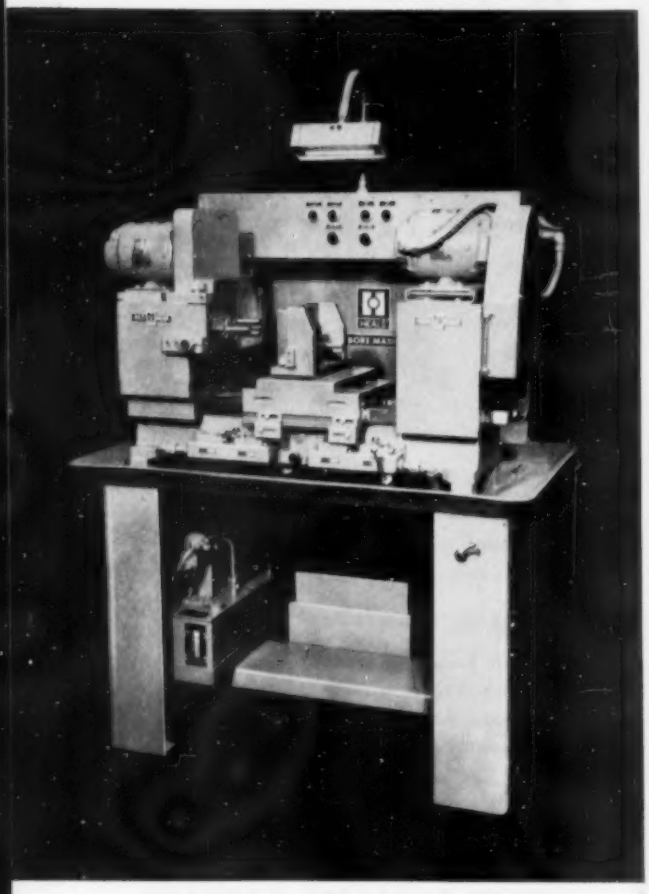
IT PAYS TO COME TO HEALD!

HEALD®

New UNIT-TYPE BORE-MATIC puts

custom-built machine design on an "off-the-shelf" basis





... offers complete flexibility for meeting virtually all small-work Borizing requirements from a STANDARD LINE

Here, for the first time, is a small, compact Bore-Matic that gives you complete flexibility of design. Its unique "building block" arrangement, with standard interchangeable head units and accessories, provide's practically unlimited versatility for meeting all of your small-work Borizing requirements with minimum machine investment.

Basically, the Model O Bore-Matic consists of a precision-built table way unit with hardened and ground box-type ways, hydraulically operated table, hydraulic power unit and all necessary controls. A variety of boringhead units, complete with motor drive, can be interchangeably mounted on the table ways at either or both ends of the machine with precise alignment.

This Model O unit is built to the same standards of accuracy and precision as any other Heald Bore-Matic. It will easily hold tolerances of .0002 on regular production work and is capable of the same type of Borizing operations as a larger Bore-Matic. Ask your Heald representative for complete information, or send for a copy of new Model O Bulletin.

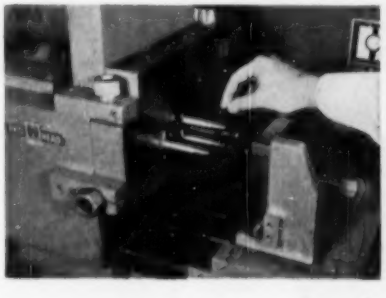
THESE STANDARD UNITS CAN BE USED IN ANY DESIRED COMBINATION

- Boringhead and Drive Unit for one or two standard Red Heads
- Multi-Spindle Boringhead and Drive Unit
- Swivel Boringhead and Drive Unit for one standard Red Head
- Hydraulic Cross Feed Units for standard or miniature heads
- Hydraulic or Manual Cross Slide
- Coolant Pump and Tank Unit
- Vertical Indexing Work Slide

NEW MULTI-SPINDLE BORINGHEAD

permits simultaneous multiple-hole Borizing on close centers

A Multi-Spindle boringhead assembly consists of any practical number and arrangement of miniature precision Red Heads, mounted in interchangeable spindle plates that are jig bored to the exact requirements of each job. Heads can be spaced as close as ¾" on centers and all holes are Borized simultaneously.



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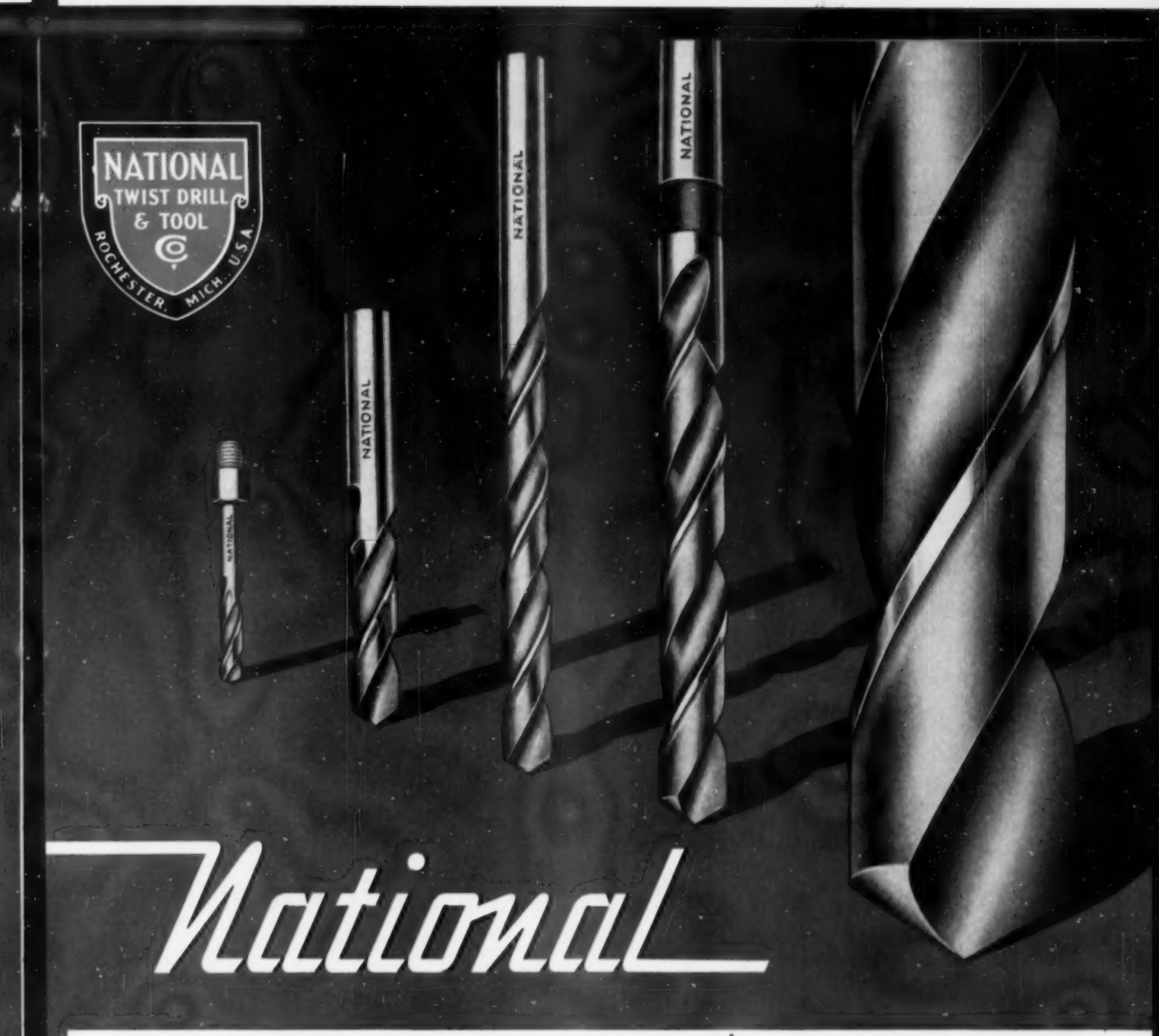

They Meet the Challenge of Today's Harder-to-Machine Metals

Not long ago it was said of some titanium and stainless steel alloys and of several high-tensile-strength steels: "They must be ground." But after concentrated laboratory research, National has improved its standard tools so that they now cut many of these harder metals.

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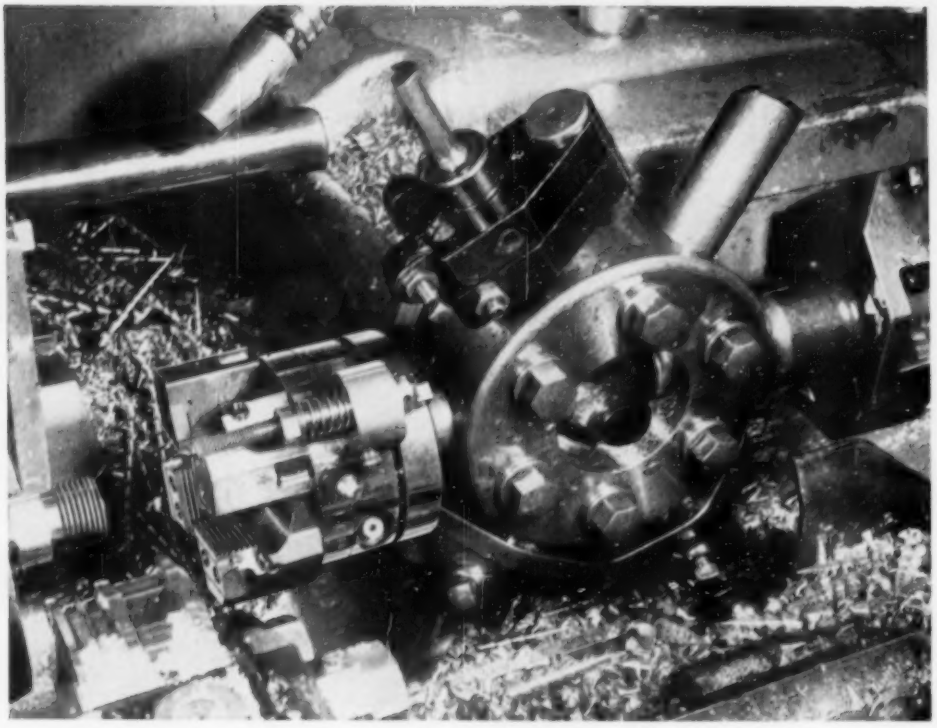
Experimental drilling of one of the hard-to-cut materials



LARGE DIAMETER THREADING

on a Brown & Sharpe automatic

Pol nuts for gas cylinders, requiring both 1⅛" and .880" diameter threads, are threaded at the Fisher Governor Co. (Marshalltown, Iowa) on a B & S Automatic using the 5 EXX LANDMATIC Head.

The EXX LANDMATIC is a compact stationary die head designed for threading operations on small screw machines. It uses tangential chasers and is built in two sizes—the ½" for No. 0 and No. 2 B & S machines with a range from #4 to ½"—and the ⅝" for No. 2 B & S machines with a standard range of #4 to ⅝". The ⅝" model can be equipped with oversize chaser holders, as shown here at Fisher Governor.

The special diameter (.880") threading operation is illustrated with a workpiece of ASTM-B16-Brass (65-80 Rockwell B). A 14 pitch UN thread has just been cut $^{17}/_{32}$" long to within .140" of the shoulder (held to .0036" on the pitch diameter). Threading at 450 RPM, approximately 150,000 pieces are completed between chaser grinds. This same head, with proper chasers and chaser holders, is used to produce 1⅛" diameter 16 pitch threads $^{13}/_{16}$" long.

The EXX Head features an adjustable spring mechanism which allows compensation of cam feed lead for threads of different pitches. Through this device the die head can be adjusted for the correct amount of pressure for the pitch of the thread to be cut. Another important feature is the external tripping mechanism which prevents premature head opening due to rapid turret indexing. These EXX Heads also offer important economies through the use of LANDIS Tangential Chasers, which are usable for 80% of their original length, and need only a few thousandths removed when regrinding.

For detailed information on LANDIS Die Heads, ask for Bulletins F-80 and F-90.

459

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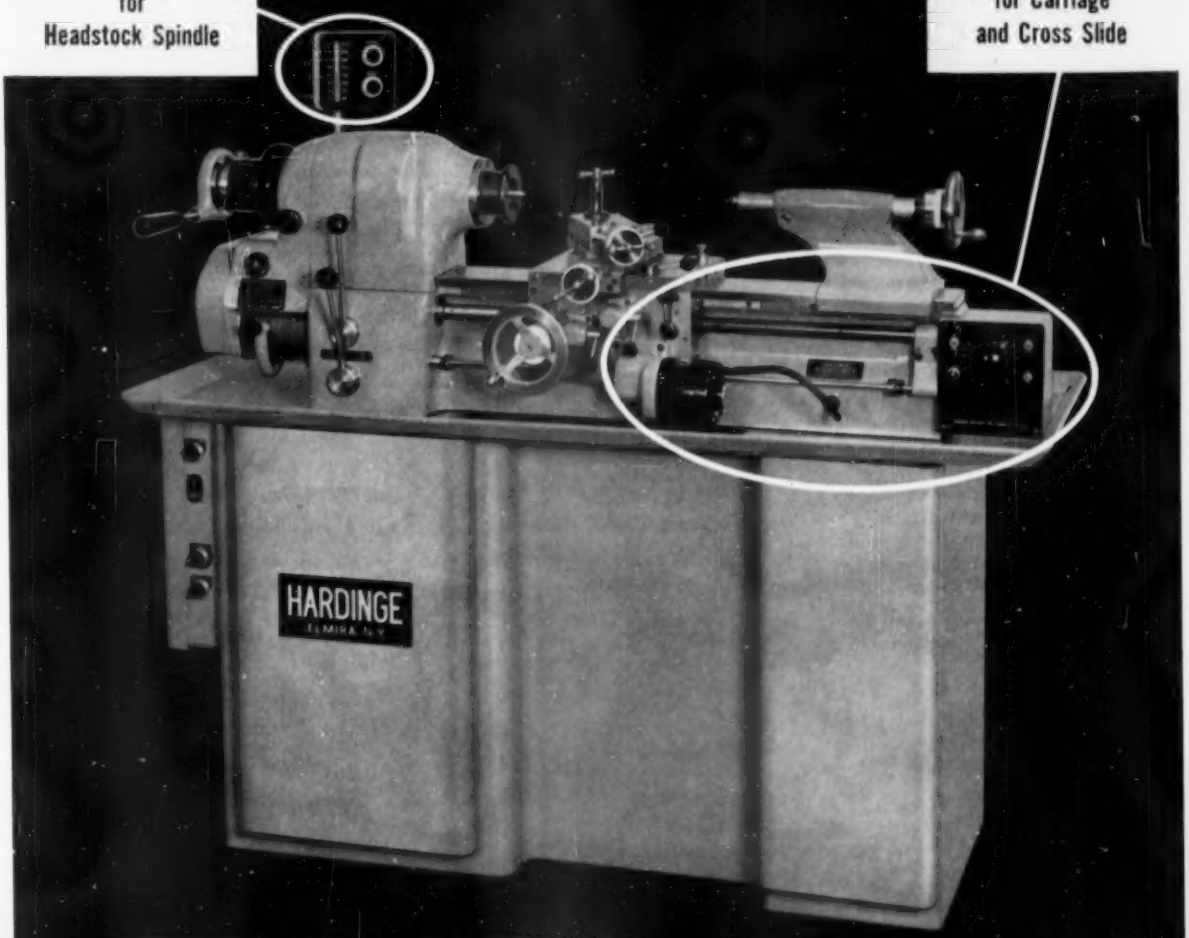

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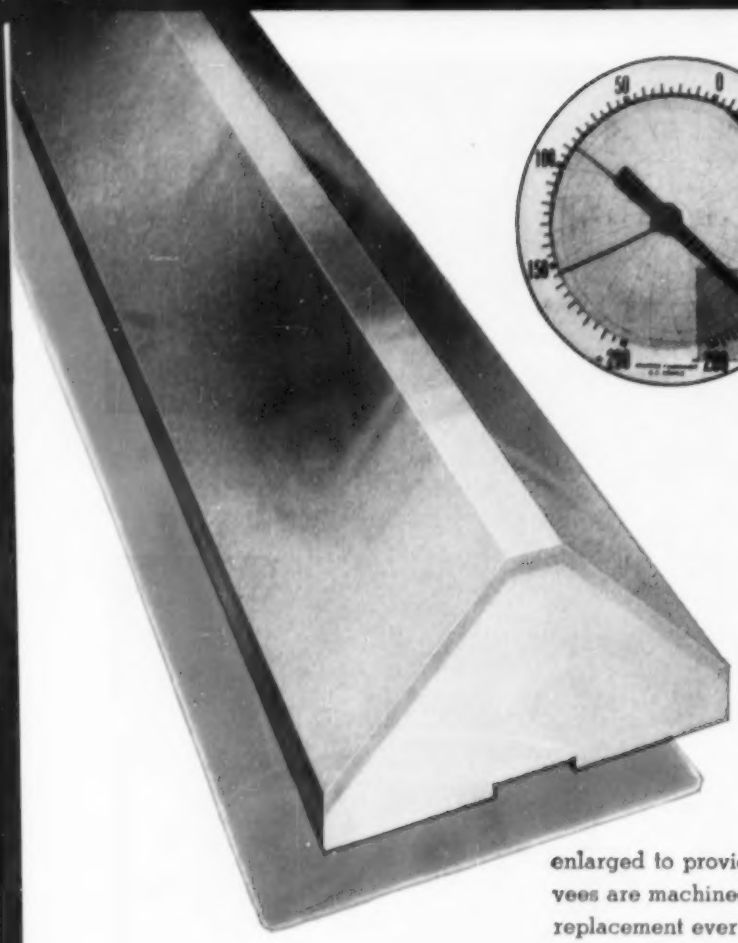

150° BELOW

After hardening to 62 Rockwell C the solid tool steel "AMERICAN" Pacemaker bed vees are stabilized in the deep freeze at 150 degrees below zero.

This freezing treatment not only raises the surface hardness but thoroughly stabilizes the metallurgical structure and prevents twisting or warping.

On the new DeLuxe Model "AMERICAN" Pacemaker the bed vees have been enlarged to provide extra large bearing area for the carriage. The vees are machined to gauge tolerances for interchangeability should replacement ever be required.

This is but one of the outstanding advantages offered by the new DeLuxe Model Pacemaker. Others are illustrated and described by bulletin No. 124—want one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

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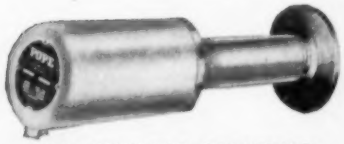


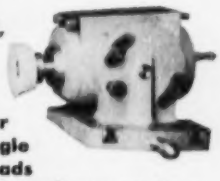
FOR SURFACE GRINDING

POPE 1, 2 and 3 HP Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with double row cylindrical roller bearings of enormous capacity for superior performance and long life, plus separate thrust bearings for no endwise movement of the shaft.

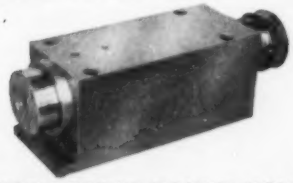
FOR HEAVY DUTY MILLING AND GRINDING

POPE ¾ to 100 HP Direct Motorized Spindles operate in any position — flanged or tapered noses — equipped with super-precision, double-row roller bearings and preloaded ball thrust bearings. Top quality performance is assured on skin milling, grinding, boring and other operations as well as milling.

FOR TOOL AND CUTTER GRINDING



POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.



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FOR INTERNAL GRINDING

POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Excello, Heald, Landis and Norton Grinders.

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POPE Super-Precision, High Frequency, Heavy Duty Spindles are available for speeds up to 100,000 RPM. They are unequalled for low cost maintenance, long life, trouble-free operation and rugged ability to cut metal fast.

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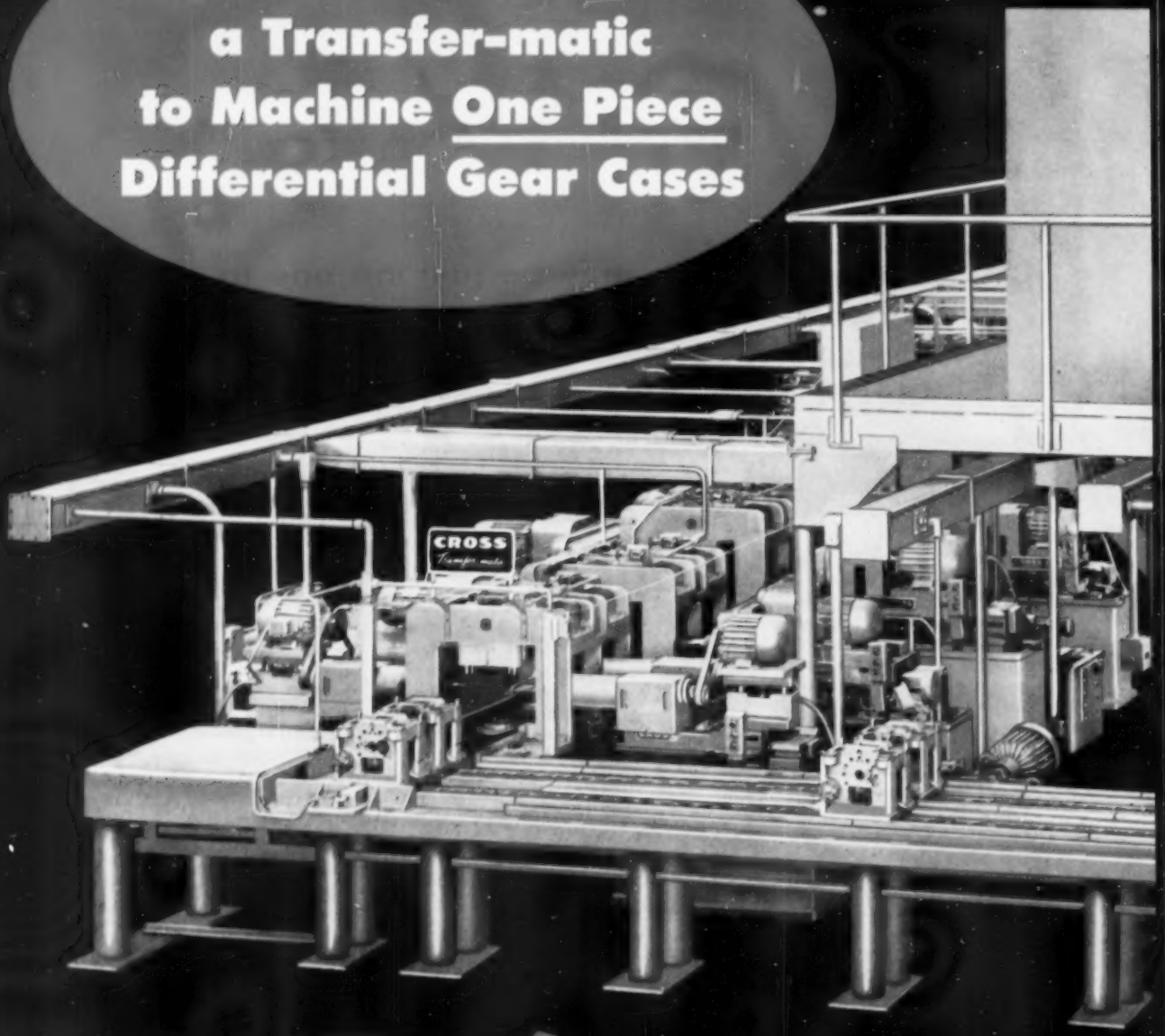
Another Cross First – a Transfer-matic to Machine One Piece Differential Gear Cases



Cutaway view of differential gear case showing machined surfaces.

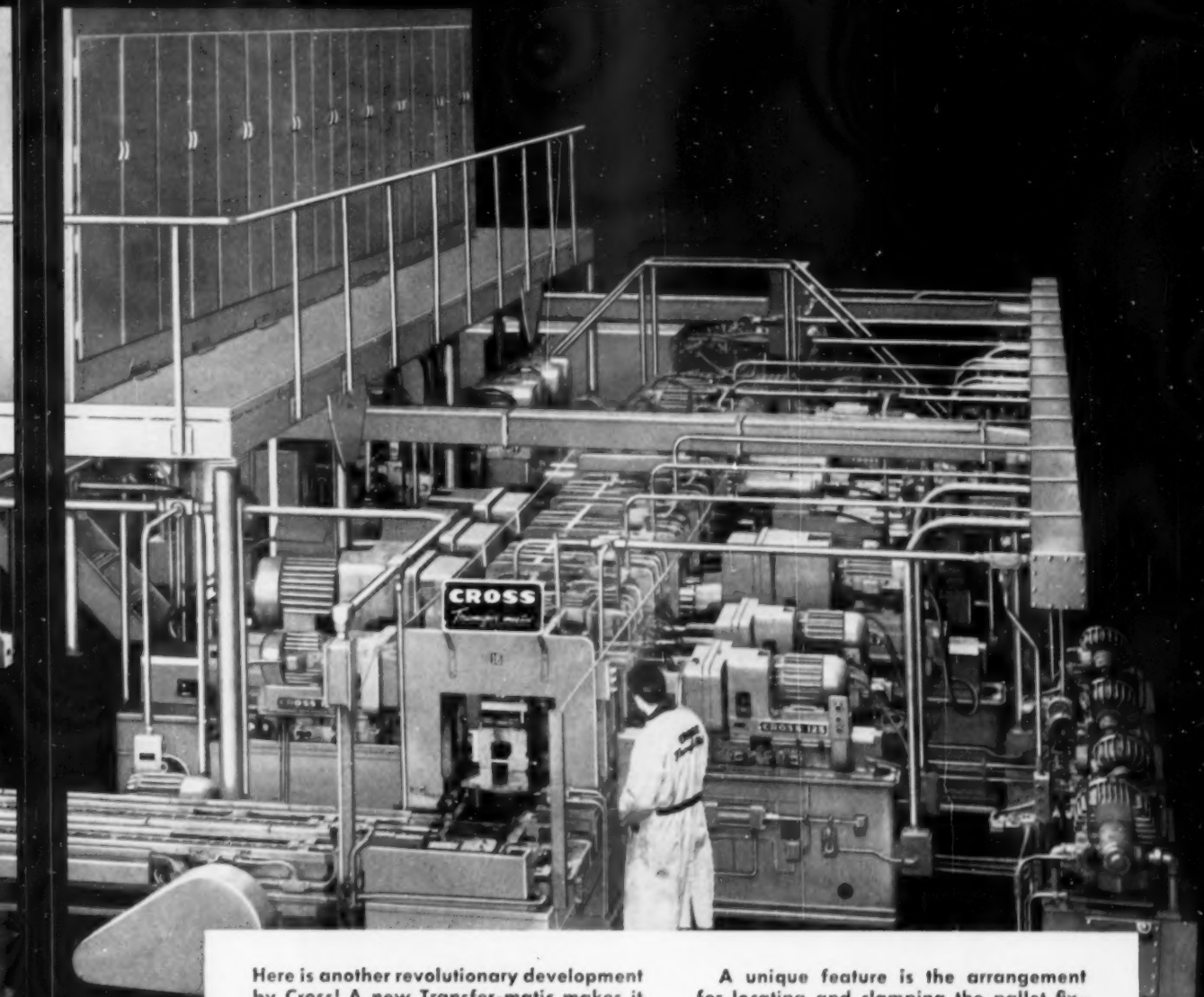
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Another Transfer-matic by Cross



Here is another revolutionary development by Cross! A new Transfer-matic makes it possible to machine and inspect *one piece* rear axle differential gear cases—the first time such a part has been processed on a transfer machine.

Two cases are machined at a time as they travel a distance of 206 feet through 30 stations. Rated capacity is 212 pieces per hour at 100% efficiency. Operations include rough and finish forming the two spherical seats for the pinions; rough and finish boring and facing the two seats for the side gears; drilling, boring and reaming the pinion shaft hole; drilling and reaming the lock pin hole; drilling, chamfering, spotfacing and reaming the twelve ring gear mounting holes.

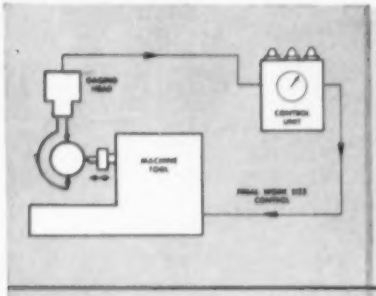
A unique feature is the arrangement for locating and clamping the pallet fixtures. In each station, elevators lift the fixtures from transfer bars into engagement with locating pins and stop buttons fixed in the overhead bridge structures. Individual wedges then back up the elevators to secure the pallets. After cutting, the elevators lower the pallets onto the transfer bars, which carry them to the next station.

Other features include construction to JIC Standards, hardened and ground ways, complete interchangeability of all standard and special parts, pre-set cutting tools and Cross Machine Control Units which program tool changes to reduce machine downtime.

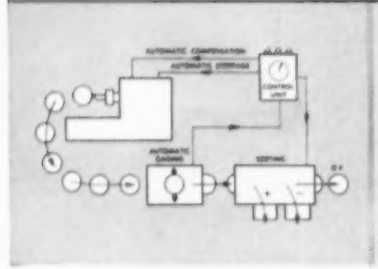
Why FEDERAL offers more

RELIABILITY THRU DIVERSIFIED EXPERIENCE

Diversity in Automatic Control



IN-PROCESS
control utilizes gage to make tool retract when part has been machined exactly to correct size.



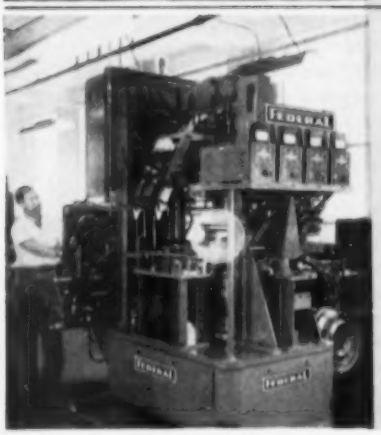
POST-PROCESS
control provides feedback of corrective signals from automatic gage to machine to maintain part uniformity. Federal pioneered both this and "In-Process" type of control.

Any type of precision gage should be reliable, but when the gage becomes part of the automated process, reliability becomes of premium importance. There's a lot at stake. Over the years Federal has developed numerous ways to greatly increase Automation Gaging reliability. For instance . . . using extremely low voltage at sensitive switching contacts. This eliminates pitting, and tremendously prolongs contact life, maintains precision. And, Federal Automatic Gages employ electronic switching . . . vastly more accurate, faster, and more maintenance-free than the use of mechanical means to actuate work-handling relays.

You don't come by these features overnight. They are the result of hard-headed experience acquired in the designing and building of many diversified types of automatic gages. This extra reliability is bound to pay off. It's reliability which you not only can afford, but which *you cannot afford to do without.* And, only Federal provides it!

Diversity in Automatic Inspection

WATCH JEWELS
Each jewel is the size of a pin-head, yet this gage automatically handles, checks and sorts 1800 per hour! Gage measures hole in jewel only .008" in diameter.



TRUCK WHEELS
This Federal Gage automatically checks 500 massive truck wheels an hour for radial and lateral runout, sorts into good and bad.

24,000 PIECES PER HOUR
This high speed automatic gage checks diameter of various size ball bearings, sorts into 12 categories of .000010" each!

21 DIMENSIONS
2400 per hour.
This gage is adjustable to automatically handle 13 sizes of turbine blades, measuring almost two dozen dimensions in only 4 stations.

Guarantee TOP Performance and Maximum Life!

in Automation Gaging!

SIMPLICITY THRU STANDARDIZATION

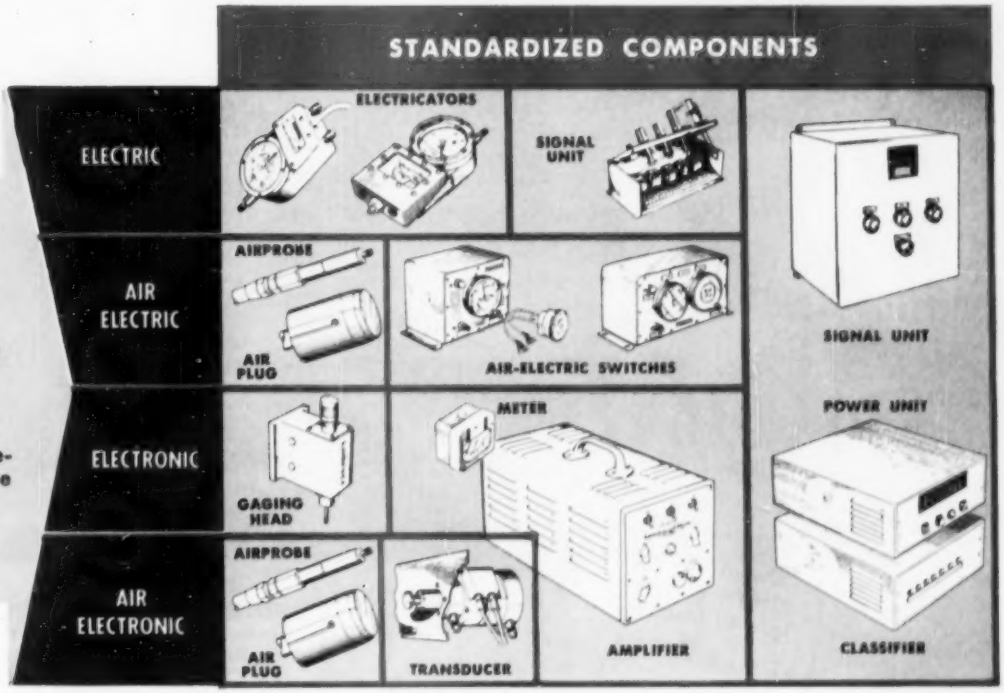
UNITIZED CONSTRUCTION
Critical elements are specially constructed for quick replaceability.

Automation will never become wholly standardized, but Federal — because it has had such long-time experience in this field — is able to meet most control and inspection demands using basic, standardized components. This means lower costs for you, for one thing . . . but much more importantly . . . it means greater reliability of performance. It means this too — much less dependence on technical talent and immediate service. Standardized units can be replaced with spares quickly and easily, should the need arise. What sizable savings in downtime costs!

This is the kind of common sense design you should have in return for your Automation Gaging investment . . . and Federal can give it to you. Ask your nearest Federal representative to come in and discuss this in terms of your own needs.

FEDERAL PRODUCTS CORPORATION
7196 EDDY STREET • PROVIDENCE 1, R. I.

4 SYSTEMS OF GAGING
Only Federal provides this flexibility to meet gaging requirements more economically.



Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Guarantee ***TOP*** *Performance and Maximum Life!*

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS

On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS

On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

Specify TEFLON HYDRAULIC ROD SEALS

On all Hydraulic Cylinders

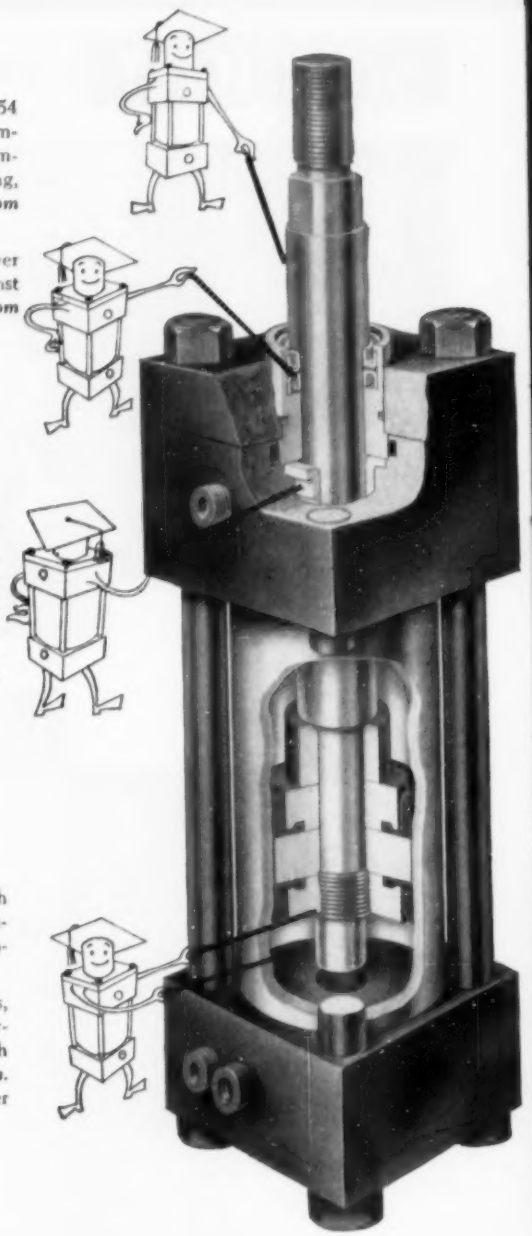
Specify RUST RESISTANT SURFACES

On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.) _____

"On all our future cylinder requirements, please specify the above quality features."

Signed _____

Title _____

NOTE. On all Miller Hydraulic Piston Seals: Leather Cup Seals are *Standard*, Piston Ring Seals are optional *at no extra cost*, and "Teflon" Cup Seals are available *at extra cost.*

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SALES AND SERVICE FROM COAST TO COAST

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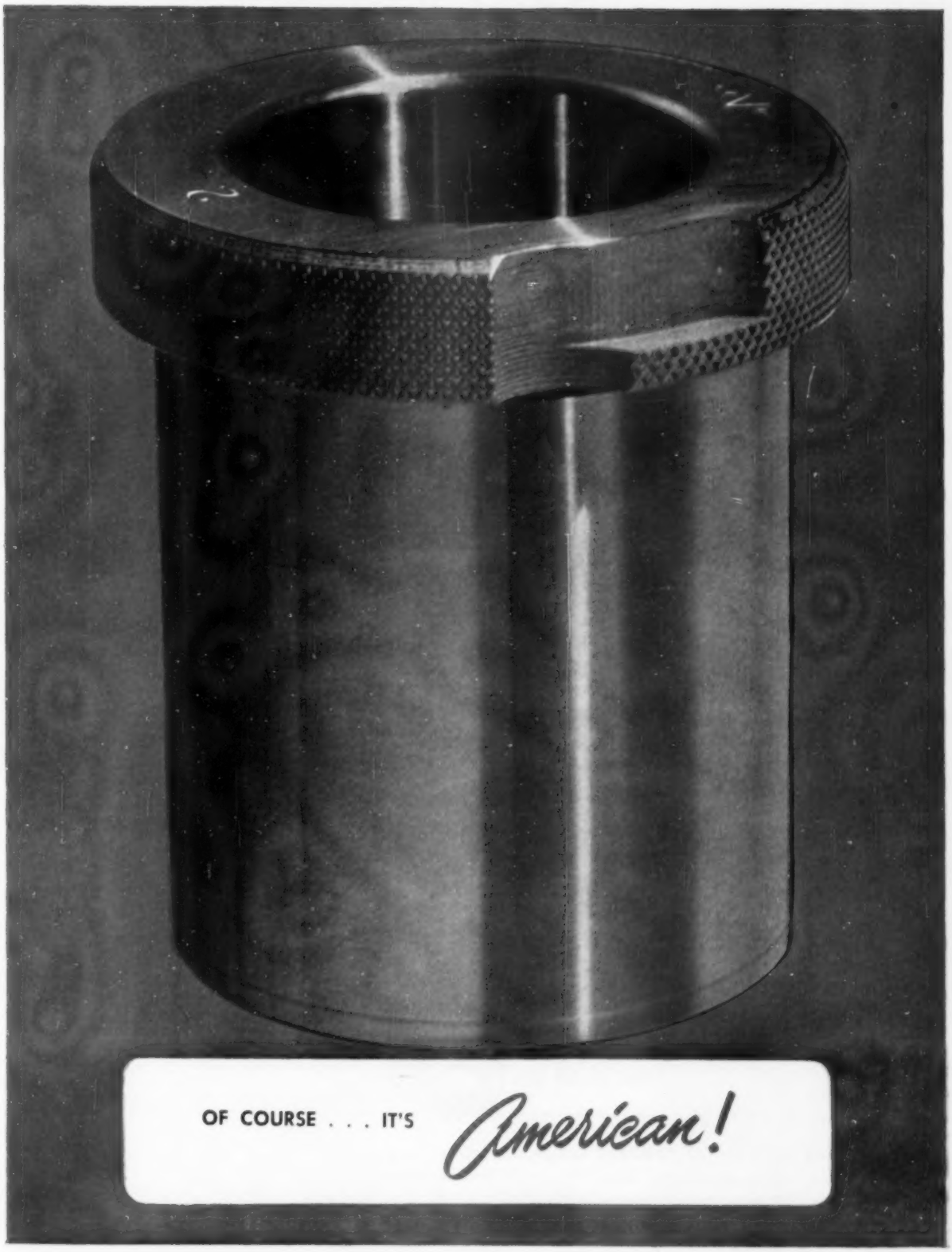
Miller

MILLER FLUID POWER DIVISION PLICK-REEDY CORP.

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS


OF COURSE . . . IT'S American!

A wheel for every job . . .

For every surface grinding job . . . whether tough as copper or fragile as glass . . . there's a Blanchard wheel that's *best.*

Blanchard grinding wheels, for use on Blanchard Surface Grinders, are made in cylinder, segment and sectored types. By selecting from a variety of vitrified, resinoid and silicate bonds and a number of different abrasives, Blanchard is able to make exactly the right wheel for every surface grinding job.

Precision duplication in the manufacture of every Blanchard grinding wheel assures you of identical results on all materials—regardless of finish or stock removal required.

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

PUT IT ON THE **BLANCHARD**

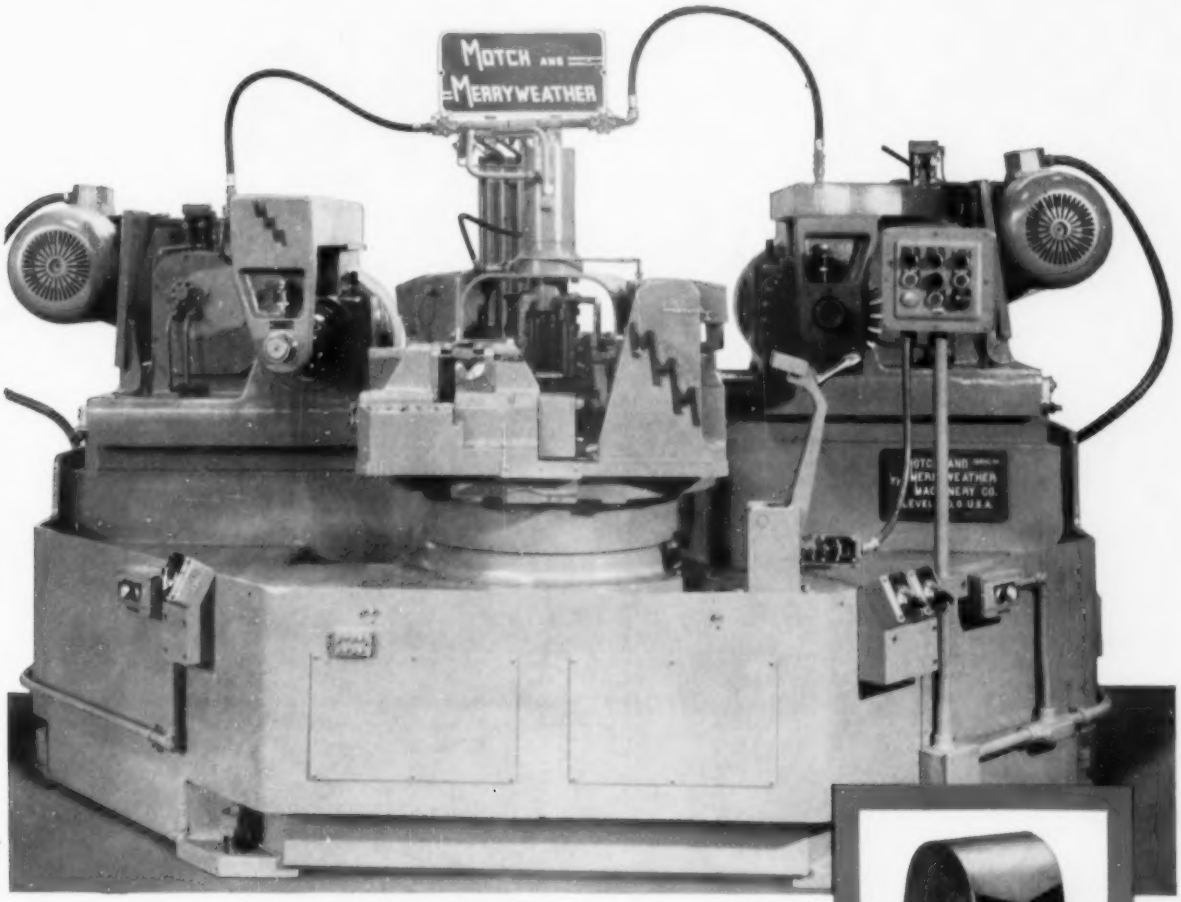
THE BLANCHARD MACHINE COMPANY 64 State St., Cambridge 39, Mass.

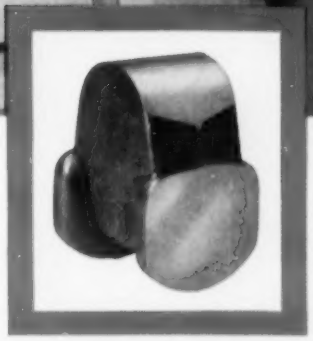
Gentlemen: Please send me free copies of "Blanchard Abrasive Wheels and Segments" and "The Art of Blanchard Surface Grinding" (3rd edition)

NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

Another specialized machine by M & M





Special duplex milling machine

for milling and slotting chain links

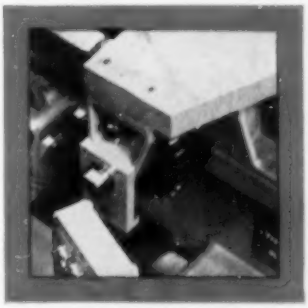
Operation—Straddle and form mill on right hand station, slot or straddle mill on left hand station.

Universal—Six different sized parts run over this machine.

Cycle—Either automatic or manual cycle. Cycle time, 64 seconds.

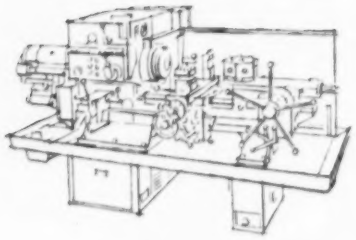
Feed—Custom-designed and built hydraulic head feed, index and clamp.

Fixtures—Four fixtures are mounted on index table.



Heavy welded steel construction, annealed milling head and rugged, all-helical gear train in heads assure continuous production with a minimum of maintenance and costly downtime.

The
MOTCH & MERRYWEATHER MACHINERY
Company
MACHINE TOOL MFG. DIVISION
CLEVELAND, OHIO



If you

were a turret lathe operator today,

wouldn't **you** *want*

to work at a machine

with this easy method

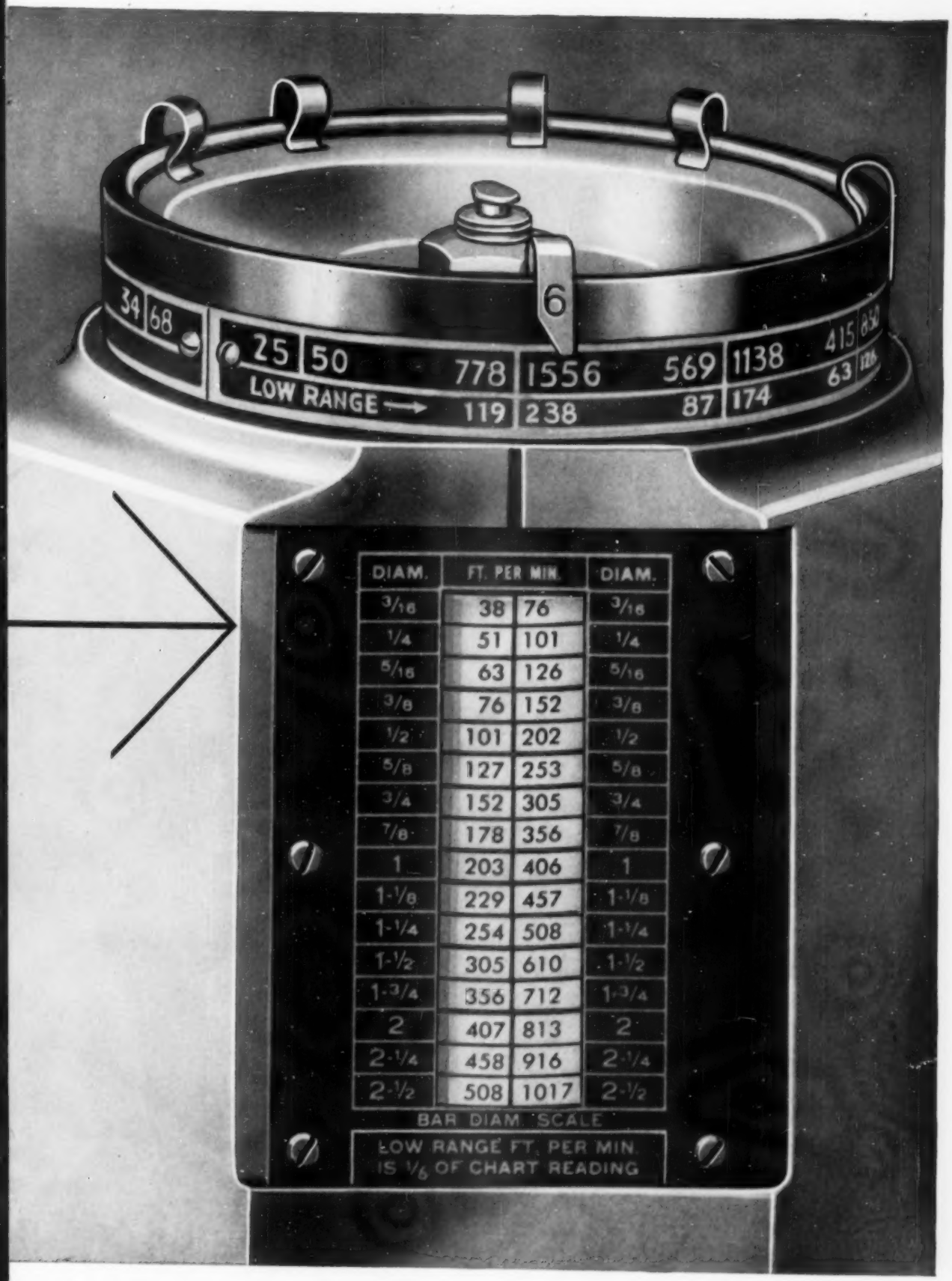
of preselection?

Only Warner & Swasey offers this direct-reading speed selector calibrated in work diameter, surface feet, and spindle rpm's—thus, no slide rules or conversion charts are required to determine proper spindle speeds. Movable number clips indicate at a glance your job's sequence of speed changes.

Ask your Warner & Swasey Field Engineer about this exclusive feature

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

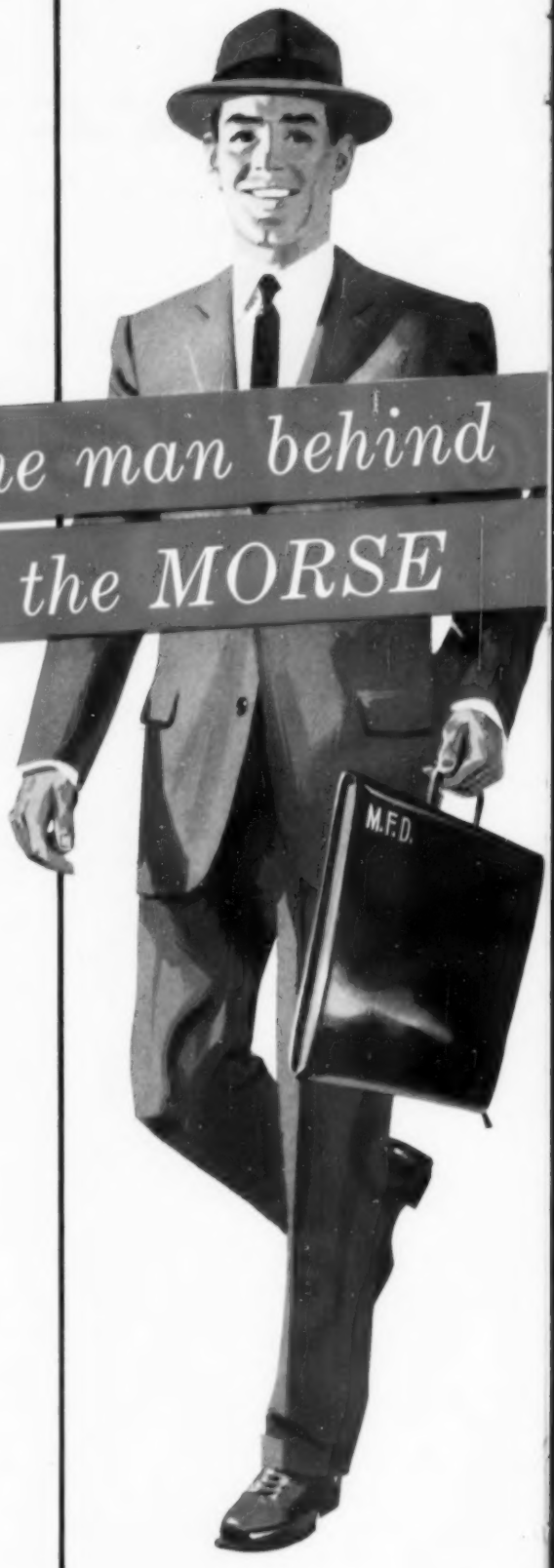


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-21

Your friend
indeed
when you're
in need...

the man behind the man behind

...the MORSE



Morse Designers...

Morse Engineers...

Morse Modernized Plant...

Morse Master-Craftsmen...

all backing up

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MORSE TWIST DRILL & MACHINE COMPANY
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A Division of VAN NORMAN INDUSTRIES, INC.
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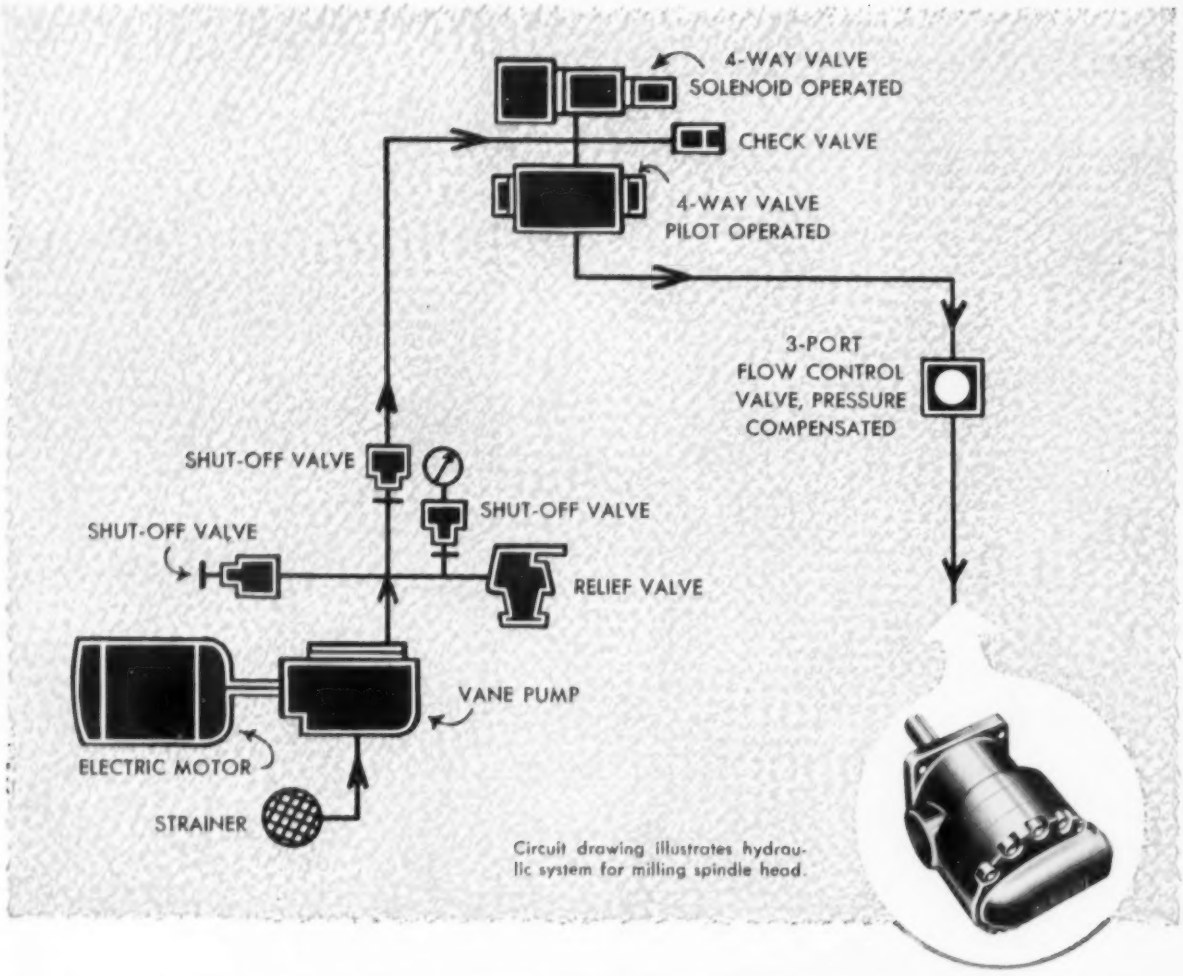
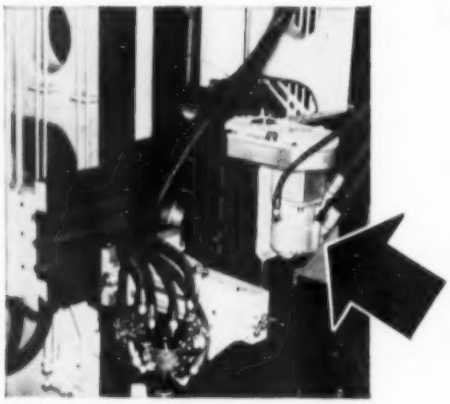
the MFD*
MASTER-CRAFTSMAN



Circuit drawing illustrates hydraulic system for milling spindle head.

Developing a compact, efficient spindle head

...another application for Denison hydraulic power



Denison hydraulic motor is mounted directly to gear case of spindle and powers driver gear of the gear train.

THE PROBLEM: to develop a compact, efficient milling spindle head with infinitely variable spindle speed and instantaneous speed selection.

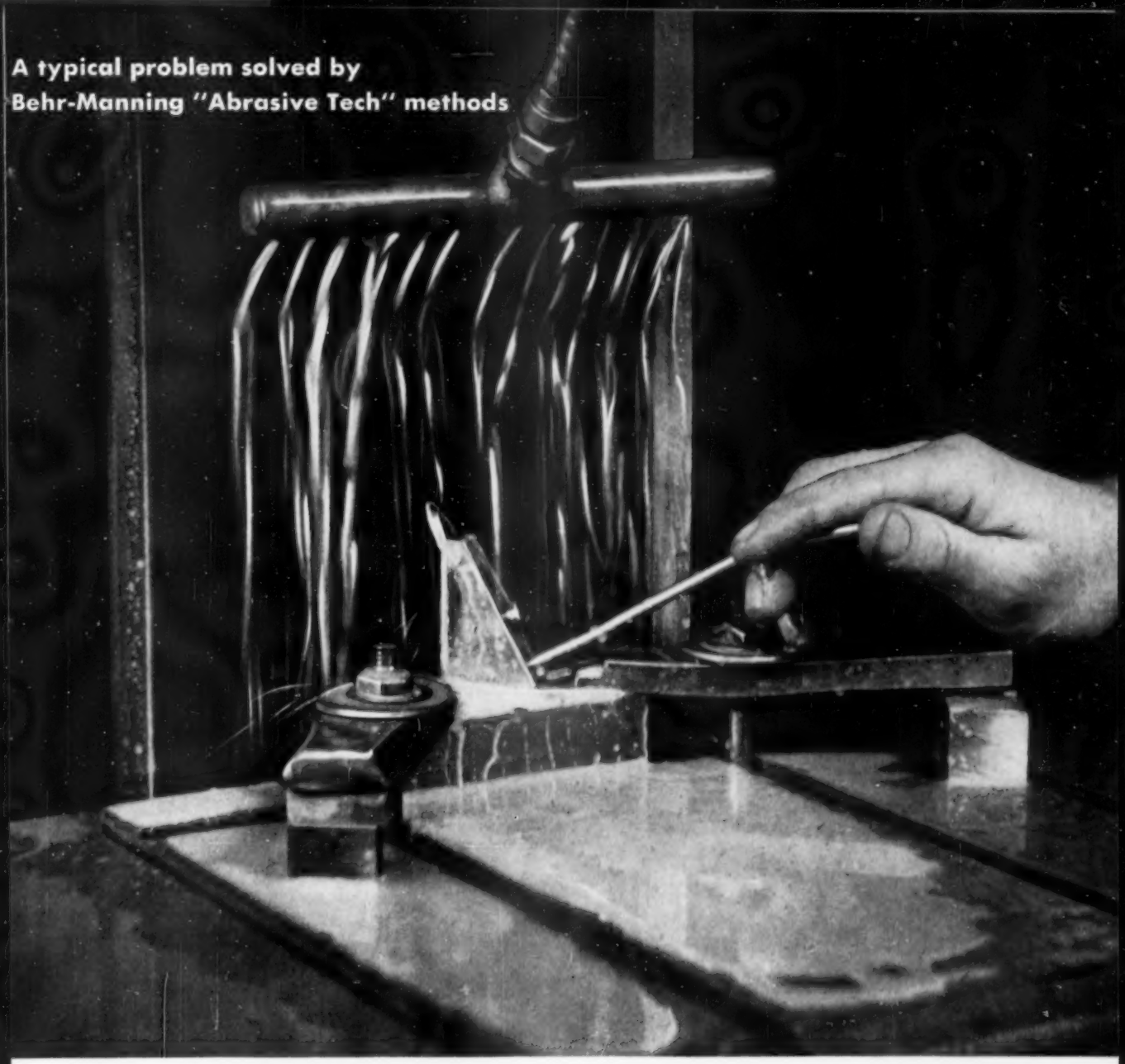
For True-Trace Sales Corporation of El Monte, California, the solution involved the use of hydraulic power... and Denison hydraulic equipment.

The result was spindle with a 15 hp rating and speeds up to 3000 RPM. To drive the spindle, True-Trace selected a Denison TMC-3 fluid motor. Variable speed control is achieved with a Denison 3-port flow control valve. The control's nine separate ranges permit exact speed selection by the operator.

Let a Denison hydraulic specialist help you with your design problems. Write Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON HydrOILics



30 minutes were cut to 18 seconds when this vertical platen belt grinder replaced a lathe in shaping boroscope mirrors. Cut at an angle from round bar stock, they need to have their bottom angle shaped to match the top angle, an operation accomplished by placing them in a fixture and rotating them against a moving Speed-wet Durite belt. This "Abrasive Tech" method is an example of the Behr-Manning technical service that may provide more production efficiency for your plant.

A Behr-Manning methods engineer can often give valuable aid in overcoming stubborn finishing problems. All you have to do is call the nearest Behr-Manning office. Seventeen well-equipped "Abrasive Tech" Methods Rooms are waiting to show you the newest techniques: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, Teterboro, Camden, San Francisco, Seattle, St. Louis, and Brantford, Canada. Main office and plant: Troy, N. Y.
For export: Norton Behr-Manning Overseas, Inc., Troy, N. Y., U.S.A.

BEHR-MANNING CO.

A DIVISION OF NORTON COMPANY

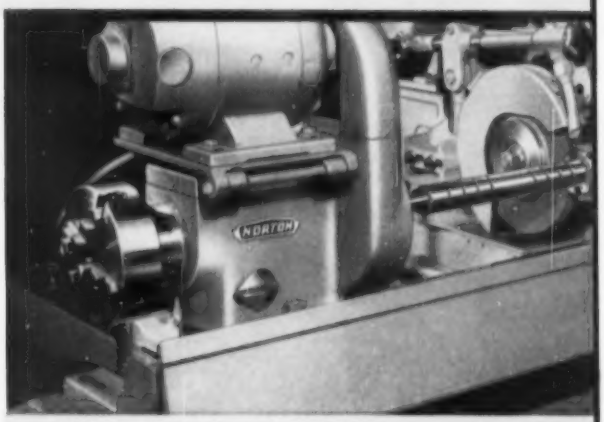
NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING ®

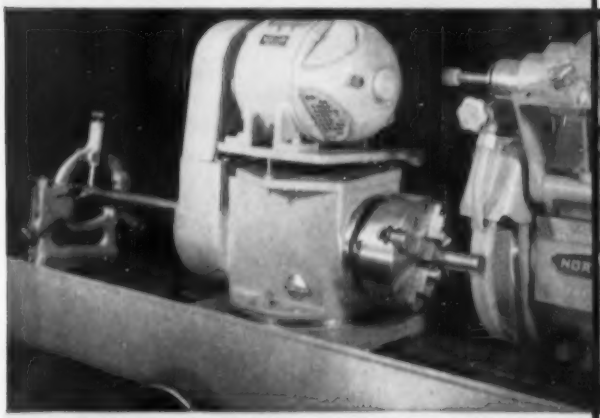
Norton builds extra versatility into universal grinders...

JOB-SPEEDING FEATURES

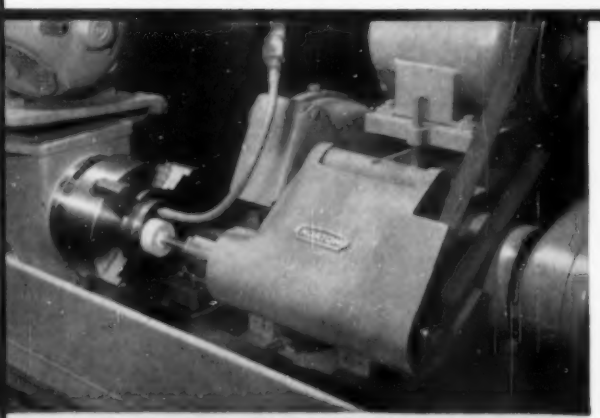


Minimum effort to change from dead center to chucking work. Chuck may remain mounted at back end of headstock while dead-center grinding.

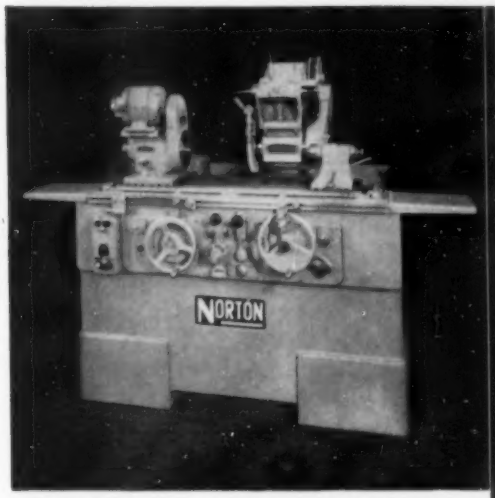
to put extra dollars in your pocket



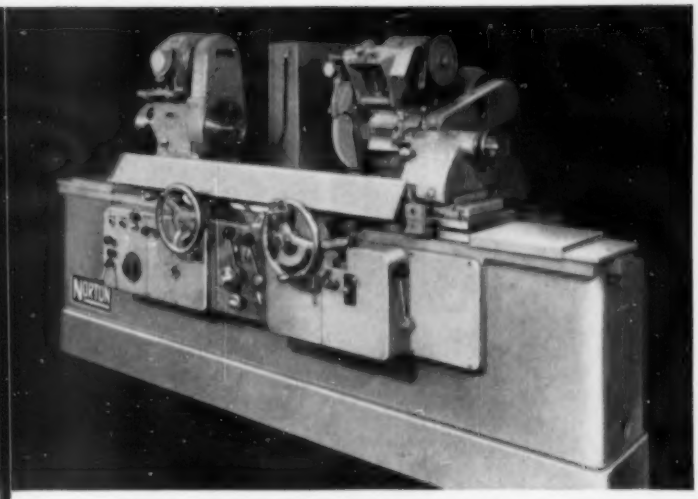
Hollow headstock spindle gives you additional capacity for grinding long bars by passing them clear through and supporting them in grinding position.



Hinged-bracket type internal grinding spindle swings up and out of the way when not in use. This means quicker setups for your I.D. or O.D. grinding.



Norton 10″ universal grinder. Made with 20″ or 24″ nominal lengths between centers. Catalog 170.



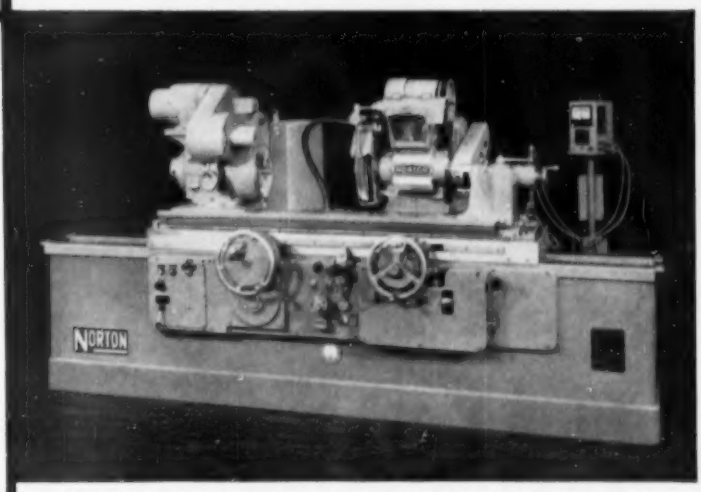
Norton 12″ Type U-4 universal grinder. Made with 36″ or 48″ nominal lengths between centers. Catalog 231.

Many a user rates his Norton universal grinder as a practically "complete grinding department." Why? Because Norton builds extra versatility into its universals for faster external, internal, face, taper and angular wheelside grinding, including many special jobs. Also they're built with many famous job-speeding, cost-cutting features: For example:

Extremely rapid chucking . . . quick change-over to live or dead spindle operation . . . easy work speed changes . . . independent wheel settings that do difficult jobs fast . . . extra capacities on wheel head and headstock . . . precise swivel table alignment with the SWIVALIGN *Dual Electric Indicator, an optional extra.*

Made In The Size You Need

Norton universal grinders are made in 10″, 12″, 14″ and 18″ swing capacities. That means you can get exactly the size to bring you many time-and-money-saving "Touch of Gold" advantages. For complete facts on these high-efficiency machines see your Norton representative or write us direct. And remember: Only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.



Norton 14″ Type U-4 universal grinder. Made with 36″, 48″ or 72″ nominal lengths between centers and also in 18″ swing capacity. SWIVALIGN* Dual Electric Indicator, at right of picture, measures swivel table adjustments and is optional on all Norton universal grinders. Catalog 819.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cut Tapes

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REDESIGNED HEADSTOCK is massive, rigid casting, eliminating vibration and assuring maximum accuracy. Electric combination clutch and brake permits fast, smooth starts and stops without overheating. The Gisholt main control (manually or hydraulically operated) and the simple push buttons and feed-stop valves speed changeovers. A wide range of spindle speeds permits peak machining efficiency on all materials.

GISHOLT JETracer (mounted in place of standard front carriage) for either single or multiple pass work. For latter, JETracer will make up to four consecutive, automatic passes from four templates of different lengths and patterns. **Standard rear independent slide** can operate any time within the general machine cycle to complete the part. **Air- or hydraulically-operated tailstock** can be easily mounted, positioned or removed.

High capacity + flexibility = economy

ISN'T THIS WHAT YOU WANT

CONSIDER WHAT YOU CAN DO with this new Gisholt MASTERLINE No. 12 Automatic Production Lathe:

Here is an automatic lathe designed specifically for high production operations—yet this machine is flexible enough to handle a variety of similar parts in small repeat lots.

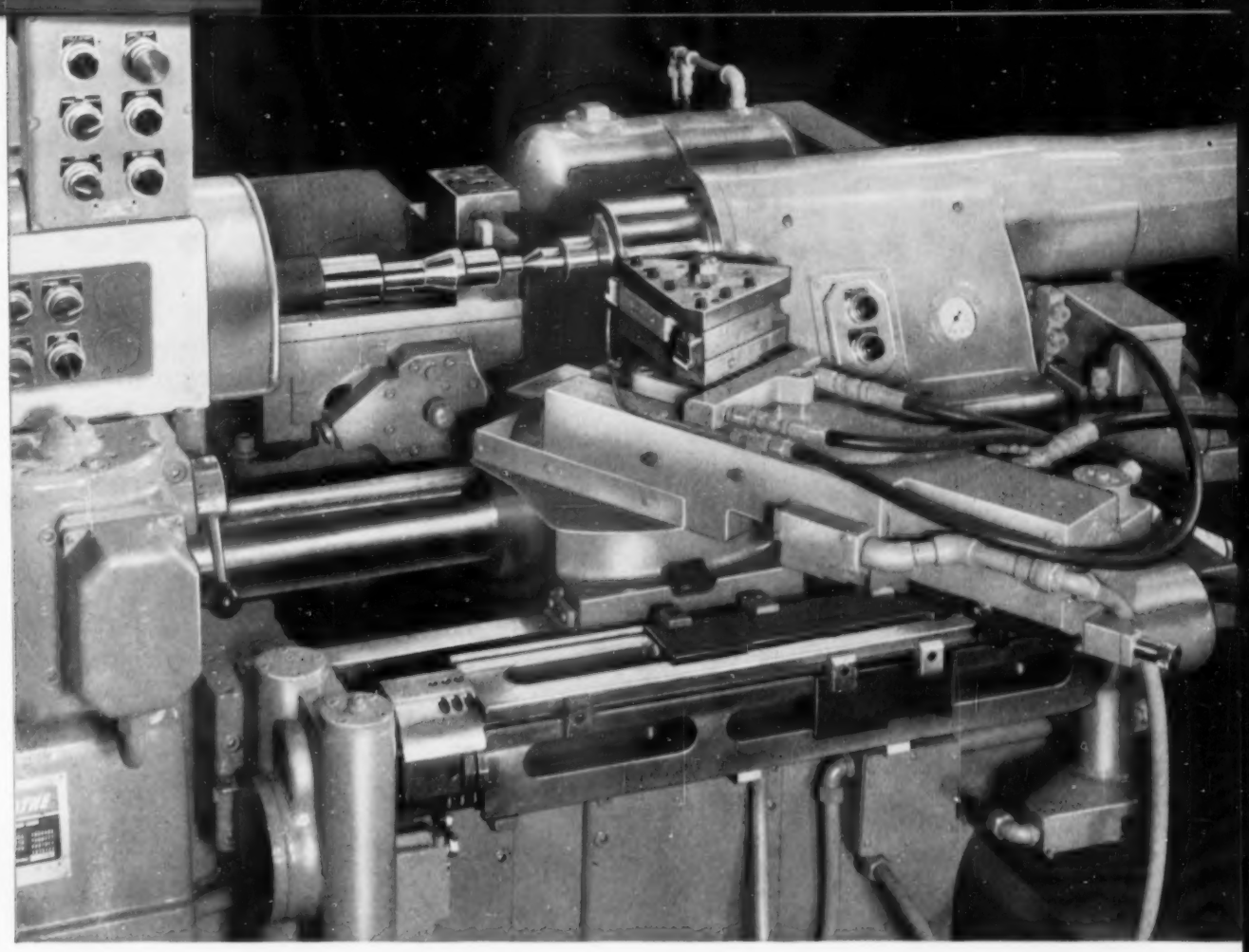
You can hold work in a chuck or fixture—with a work driver and tailstock—on an arbor or between centers. To start the automatic cycle, your operator simply loads the part, chucks it and raises the Main Control Lever. He is then free to handle additional machines—or to perform other work—until the part is completed.

On the Gisholt No. 12 Automatic, all carriage and slide movements are hydraulically actuated. The front carriage has both longitudinal and transverse motion—or a combination of the two—with quick approach, automatic tool relief and rapid return. You can mount the rear independent slide at any angle to machine bevel gears, drill cones, or handle other parts with angular surfaces.

For special jobs—like machining both ends simultaneously on small motor frames, cylinder sleeves,

MASTERLINE GISHOLT SINCE 1887

GISHOLT



IN AN AUTOMATIC LATHE?

or similar parts— you get even greater flexibility from the No. 12 through auxiliary slides, operated by movement of the standard slides. Or you can mount a back facing attachment within the spindle—for still another way to machine a maximum number of surfaces in one chucking. And for outstanding versatility with great savings in tool and setup costs, the front carriage on the No. 12 may be replaced by a single- or four-pass JETracer slide.

For complete details of the new features on the Gisholt MASTERLINE No. 12 Automatic Production Lathe, call your Gisholt Representative.

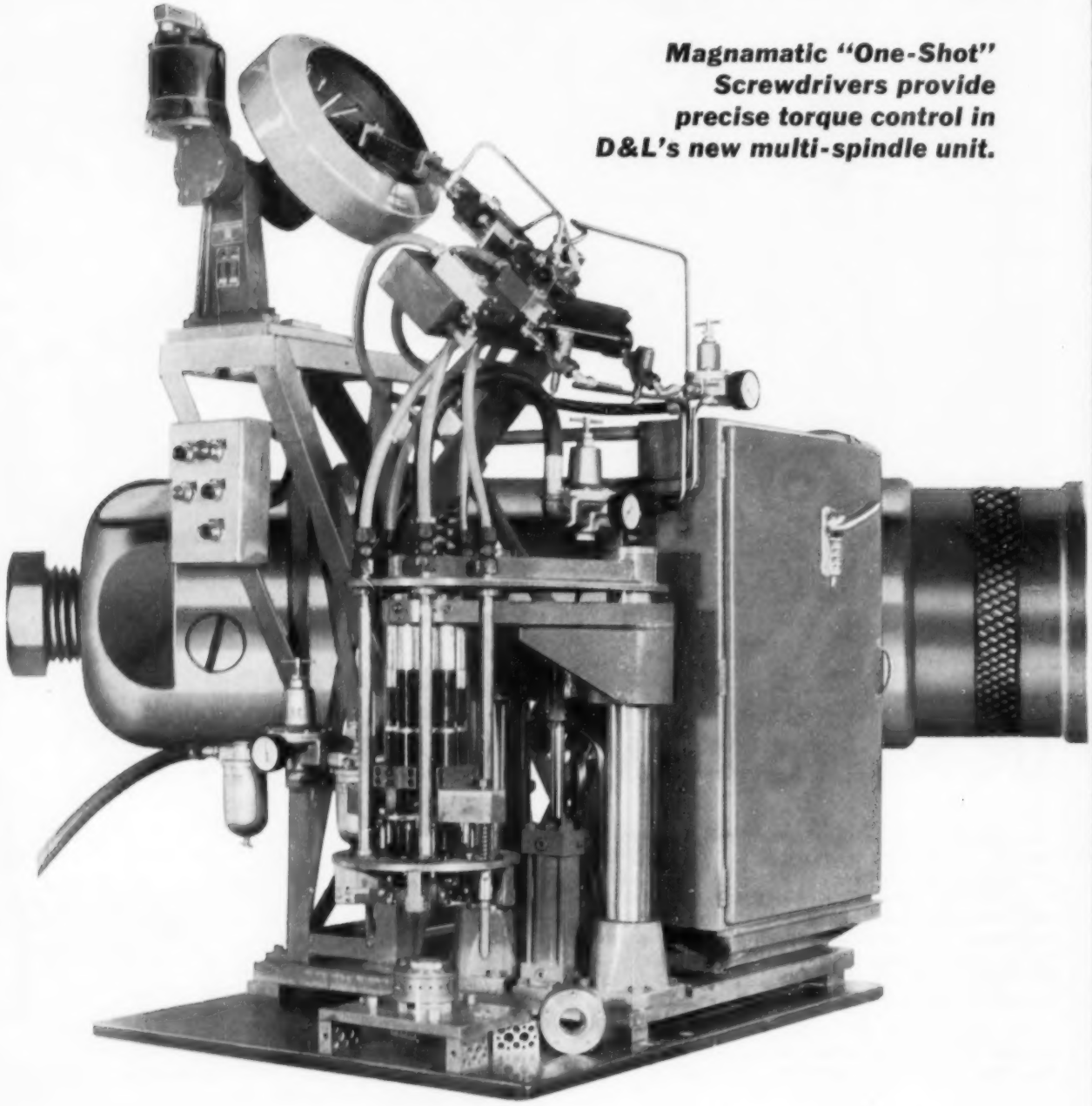
WRITE GISHOLT TODAY for advance data on the new Gisholt MASTERLINE No. 12 Automatic Production Lathe. Ask for Form 1178.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

D&L* selects

Magnamatic "One-Shot" Screwdrivers provide precise torque control in D&L's new multi-spindle unit.



D&L TOOL AND MACHINE COMPANY*

990 S. Oakwood, Detroit 17

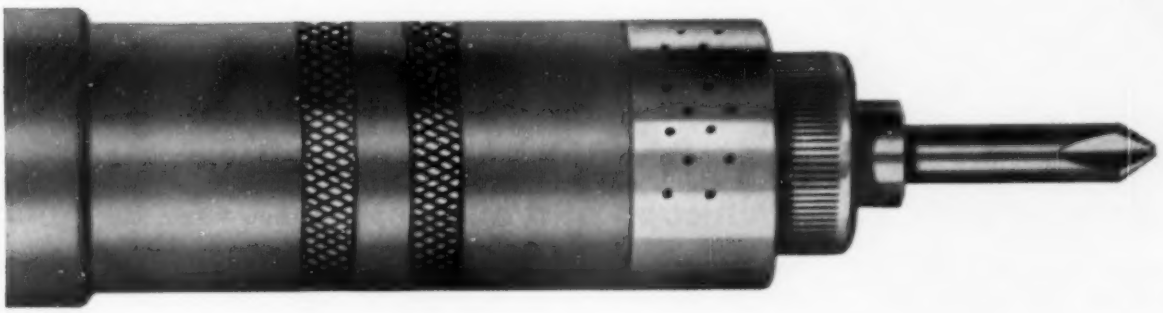
Manufacturers of automatic single and multi-spindle screwdrivers and nutrunners for automation assembly lines.

"MAGNAMATICS"...

The D&L Tool and Machine Company's newest development is a fully automatic multiple screwdriver that feeds and drives five screws simultaneously *to desired torque* . . . at a rate of 3500 screws an hour!

D&L's development engineers specified "One-Shot" Magnamatic drivers. Studies from hundreds of difficult fastening assignments proved that Magnamatic is the only screwdriver clutch that fully meets the demands of high speed, fully automatic screwdriving equipment. Because Magnamatic "thinks for itself", its torque-setting clutch jaws disengage the instant desired fastener torque is reached . . . there's no clutch ratcheting or impacting to cause jaw wear . . . the absence of ratcheting means consistent torque settings that don't need readjustment; the absence of impacting means longer bit life, and no possibility of burred screw heads, stripped threads, or sheared fasteners . . . air line pressure variations don't affect delivered torque . . . torque output can be changed to suit job requirements.

Investigate the possibilities of Magnamatic. Let our Field Engineers show you how the wear-free clutch components of Magnamatic "One-Shot" screwdrivers and nutrunners will insure accuracy and consistency in all automatic multiple units.



Complete line of motors and clutches available for constructing multi-spindle screwdriving and nutrunning arrangements. Capacities #2 screws to bolts requiring 120 pounds of torque.

Portable multi-spindle units featuring Magnamatic "One-Shot" nutrunners and screwdrivers are also available.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Chicago Pneumatic Tool Company, Dept. M-55
8 East 44th Street, New York 17, N. Y.

_____Please send me full information about multi-spindle units featuring "Magnamatic" screwdrivers.

_____Please send me FREE booklet SP-3165 "Magnamatic Case Histories"

_____Have representative call.

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Company_____

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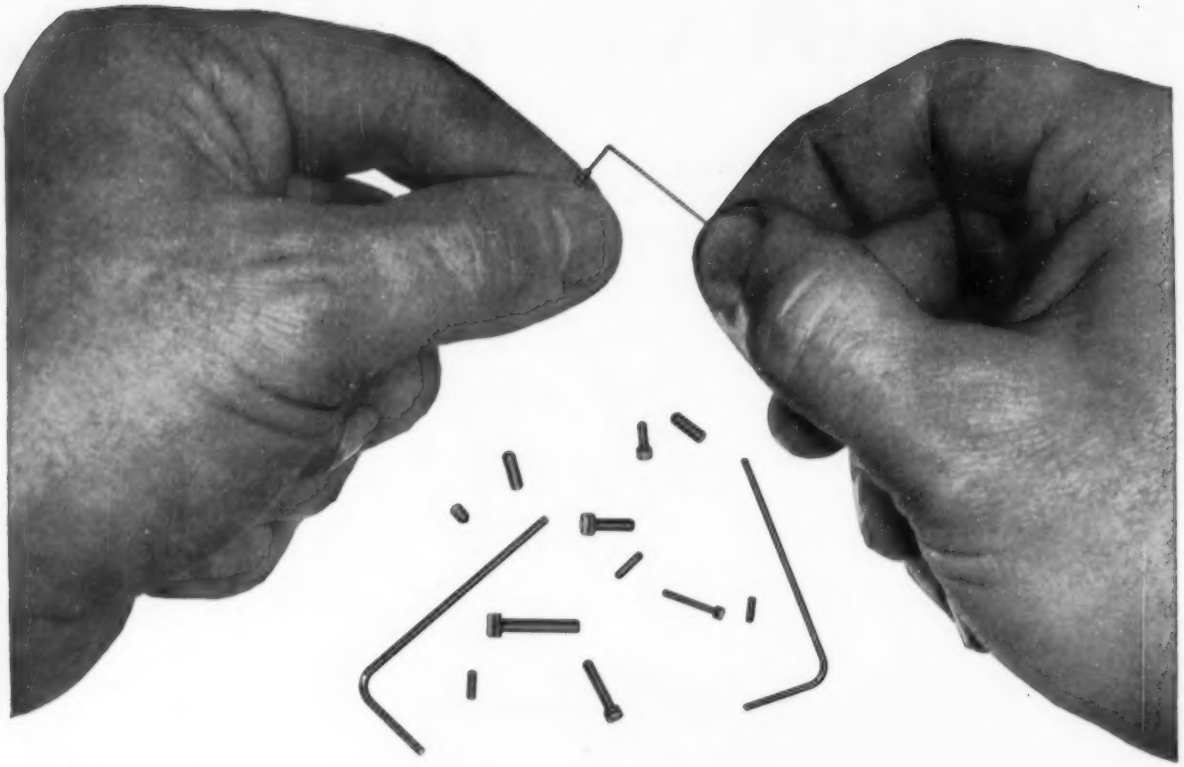

If you're miniaturizing . . . you'll save space, time and money with Allen Minicaps and Minisets (#0 thru #3 dia.)

These miniature Allen Hex Socket Cap and Set Screws will let you scale down your product sizes even farther. They're made from Allenoy special alloy steel — so strong that you can safely specify fewer screws or smaller sizes.

Allen Minicaps and Minisets are tiny, but very tough! — true Allens, with deep, clean, strong sockets and uniform Class 3A threads. Minicaps have the Allen knurled "Grip-Head" and are trimmed both on top and *under* the head, for tighter fit and better appearance. Minisets have the improved small-cup Allenpoint that drives deeper and holds tighter.

Because sockets are uniformly true hexagon shape, the key or driver fits tight — makes starting much easier, saves a lot of time in assembly.

Diameters of these miniatures run from #0 through #3. Minicap lengths run from ⅛" through ½", and Miniset lengths from 1/16" through ¼". Also standard in stainless steel. Your Industrial Distributor has them now. He'll show you why these Allens — like all Allens — hold tighter and last longer. Or write for information and samples.

Use Minicaps and Minisets wherever you need dependable fastening in very small assemblies:

TV, radio and telephone equipment • Guided missiles, rockets • Panel meters • Electro-mechanical devices and servo-systems • Computers • Control and operating mechanisms for relays • Cameras • Instruments

Stocked and sold by leading industrial distributors everywhere

ALLEN MANUFACTURING COMPANY
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ALLEN HEX-SOCKET SCREWS HEAD

*Controlled Measure

There's something majestic about a bridge. We often view it in its entirety . . . without appreciating the many components that contribute toward its strength as a unit.

Yet — even in such a huge structure . . . controlled measure is important.

Precision and balance of parts are carefully engineered for stress and strain. Each part must fit in ratio, as accurately as the intricate pieces of a delicate instrument.

Bath cylindrical plug or thread, ring or reversible type gages, guarantee controlled measure of component parts on the inspection line.

Made for dependable service and long wear-life . . . Bath gages are your best buy for reliable check of threaded and plain parts.

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INTERNAL MICROMETERS

*When you buy Bath Gages . . .
you buy controlled measure!*

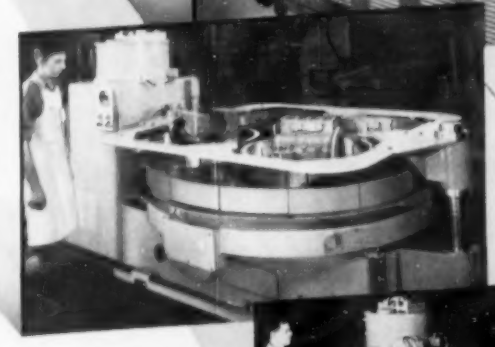
for the best buy . . . buy Bath

in this line-up . . .

Model 12 handles 3 4-in. dia. parts up to 705 ¼-in. dia. parts per load.

Model 24 handles 3 9½-in. dia. parts up to 3900 ¼-in. dia. parts per load.

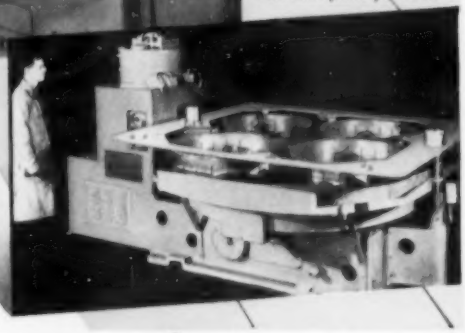
Model 36 handles 4 13¾-in. dia. parts up to 4000 ⅜-in. dia. parts per load.



Model 48 handles 4 17-in. dia. parts up to 940 1-in. dia. parts per load.

Model 72 handles 4 27-in. dia. parts up to 2480 1-in. dia. parts per load.

Model 84 handles 4 32-in. dia. parts up to 3500 1-in. dia. parts per load.



there's a specific *Lapmaster*® to give you:

1 *Precision Flatness*

2 *Precision Finish*

in production quantities

Parts large or small—tall or squat—whatever the case may be, there's a Lapmaster tailor-made to meet your production requirements at the lowest possible cost per piece.

If you are now lapping by other means—hand scraping or grinding—it will pay you to investigate the Lapmaster. Our fully equipped lapping laboratory is at your disposal to analyze your problem, test run a number of pieces and furnish you with a complete production report without obligation.

"John Crane" Lapmasters are capable of consistently producing flatness to less than one light band (11.6 millionths of an inch), microinch finishes of 2 to 3 RMS on all materials including cast iron, steel, magnesium, aluminum, brass, carbon, ceramics and plastics.

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Free data

These 3 booklets on Production Lapping and Light Band Reading are yours for the asking. Write today.

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INDEX *short or long runs on a production basis*

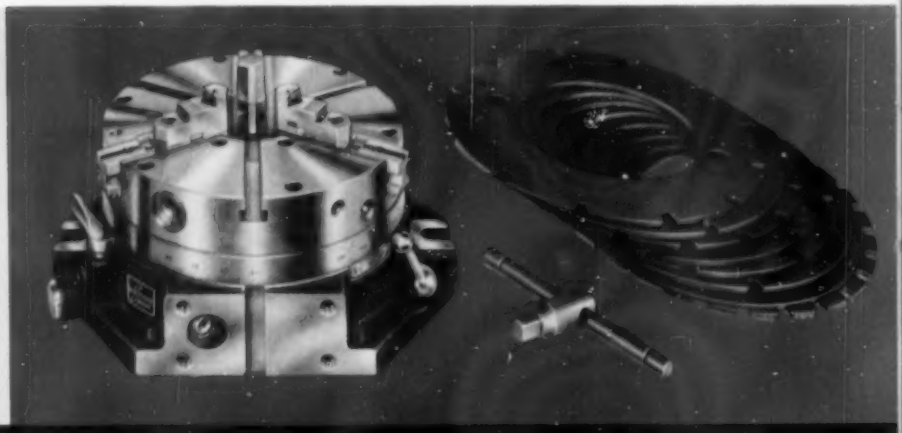
with Hartford Special SUPER-SPACERS

- Quick, easy setups without expensive jigs or fixtures.
- Positive, rapid indexing accuracy guaranteed within one minute of arc.
- Super-Spacer can be indexed visually to any degree setting with Vernier accuracy, and locked in position.

12" SUPER-SPACER

Length overall:	16"
Width overall:	12½"
Base to chuck face:	6 1/32"
Width of keys:	1/16"
Thru hole diameter:	4"
Chucking diameter:	½" thru 12½" O.D.
Weight:	190 lbs.

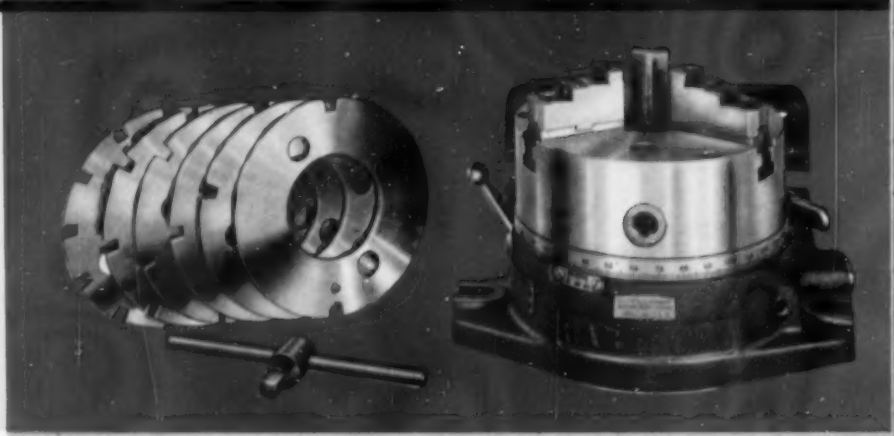
Mask plates for divisions from 2 through 27 are available from stock. 2, 3, 4, 6, 8, 12, 16 and 24 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order. 48 notch master index plate furnished with standard unit. Special master index plates for 27 through 54 divisions carried in stock. Special index plates for unequal spacing made to order.



8" SUPER-SPACER

Length overall:	12⅛"
Width overall:	10⅛"
Base to chuck face:	6 3/64"
Width of Keys:	1/16"
Thru hole diameter:	2½"
Chucking capacity:	⅛" thru 8" O.D.
Weight:	110 lbs.

Mask plates for divisions from 2 through 18 are available from stock. 2, 3, 4, 6, 8 and 12 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order. 24 notch master index plate furnished with standard unit. Special master index plates for 16 through 36 divisions carried in stock. Special index plates for unequal spacing made to order.



Thousands of users the world over proclaim Hartford Special Super-Spacer The Standard of Indexing Devices for —

Milling	Boring	Inspecting
Drilling	Slotting	and other
Tapping	Planing	Machining Operations

A complete line of accessories available. See the Hartford representative in your area or write for Bulletin S-104.

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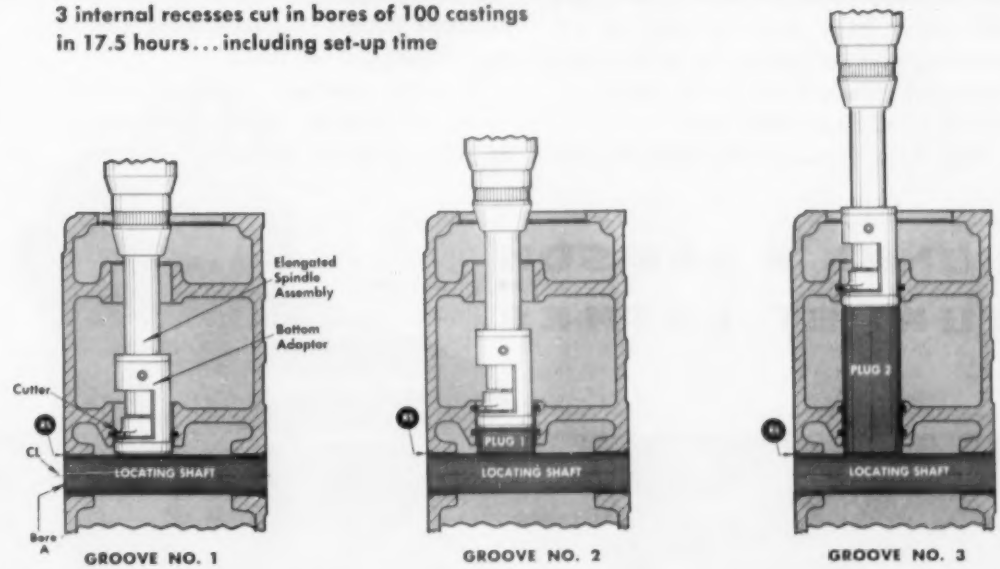
Hartford Special also makes Drilling and Tapping Machines, Machine Components, Special Machines and Automatic Thread Rolling Machines.

MACHINE TOOL ACCESSORIES DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
2806 HOMESTEAD AVENUE HARTFORD 12, CONN.

Waldes Truarc Grooving Tool pays for itself with big savings on one small run!

3 internal recesses cut in bores of 100 castings in 17.5 hours... including set-up time



GROOVE NO. 1 GROOVE NO. 2 GROOVE NO. 3

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

To overcome these obstacles a Waldes Truarc Grooving Tool was equipped with an elongated spindle assembly and bottom adaptor. The tool was mounted in a drill press, the castings in a large vise. Grooves were then cut as follows:

Groove No. 1: A locating shaft was inserted into bore A as a reference surface and the tool piloted into the housing until the bottom adaptor banked on the shaft. The tool is designed so that the cutter rotates in a neutral position until additional downward pressure is applied. It then moves into cutting position until preset groove depth is reached, after which the tool idles. Release of pressure returns the cutter to neutral so that the tool may be withdrawn.

Groove No. 2: Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

Groove No. 3: Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

No recessing problem is too tough for the amazingly versatile Waldes Truarc Grooving Tool. It's so simple even unskilled labor can use it accurately.

Write for a 20-page manual containing full information on Waldes Truarc Grooving Tool.

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TRUARC®

GROOVING TOOL

U.S. Pat. 2,411,426.

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Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)

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YE 069

The ONLY Turret Lathe with a fully automatic thread-chasing cycle!

Here is full turret lathe versatility and a threading attachment with a fully automatic cycle — all in one machine. Now you can be sure of concentricity of threading with other lathe work, *all done in one chucking*, with the time saving of the Auto-Threader! Nowhere else in the world can this be found on a turret lathe.

This Auto-Threader will chase straight or taper threads — or a combination — internal or external, from the front of the machine.

Concerning this J&L development, a customer writes: "We are tripling production on many of our items."

Write for descriptive folder No. 5440. JONES & LAMSON MACHINE COMPANY, 518 Clinton Street, Springfield, Vermont.

JONES & LAMSON
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the man who needs a new machine tool is already paying for it

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools — Thread & Form Grinders

We hate to admit it but we had trouble with a

Bellows Air Motor

in Reading, Pennsylvania

Bellows Air Motors — the unique air cylinder with the built in valve — have established enviable records for trouble free performance. Operating cycles of 20,000,000 to 30,000,000 without maintenance of any kind are quite common. Fifty million cycles nothing unusual.

But trouble sometimes occurs — even in the best regulated families. A few weeks ago we received a phone call late at night. A Bellows Air Motor on an important production line had gone haywire. Could we ship a replacement immediately? We did better than that. We had a Bellows Field Engineer at his plant at 8:00 the next morning. At 9:00 the line was back in operation.

More than 125 Bellows Field Engineers (one or more in every major industrial area in the United States and Canada) are your assurance that if you ever do have trouble with any Bellows equipment it will be remedied quickly with minimum down time. (But between us girls, trouble with Bellows "Controlled-Air-Power" Devices is most unusual!)

The Bellows Co.

AKRON 9, OHIO

MANUFACTURERS OF CONTROLLED-AIR-POWER DEVICES FOR FASTER, SAFER, BETTER AND LOWER-COST PRODUCTION

830-B

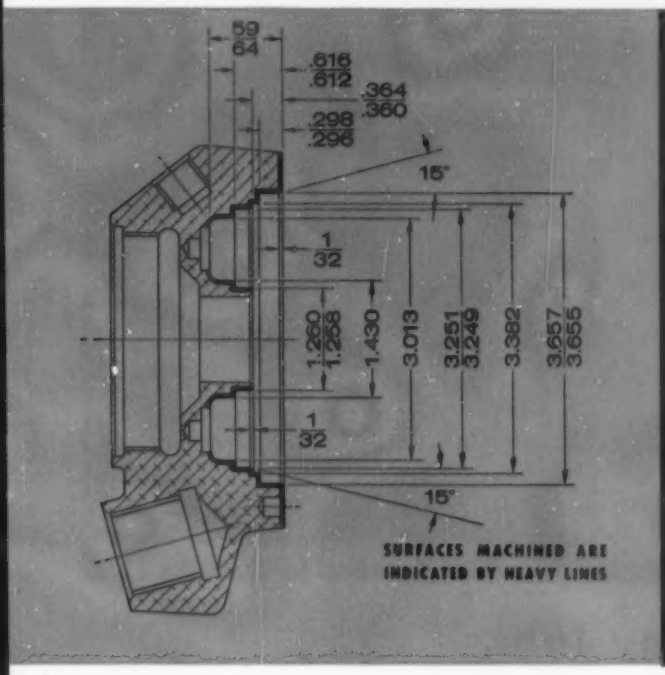
Operators know Card taps are action-mated precision performers — for example, on materials like cast iron, brass, stainless steel, aluminum and magnesium. That's because these top-quality tools are always available with different cutting angles and surface treatments — at standard prices. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

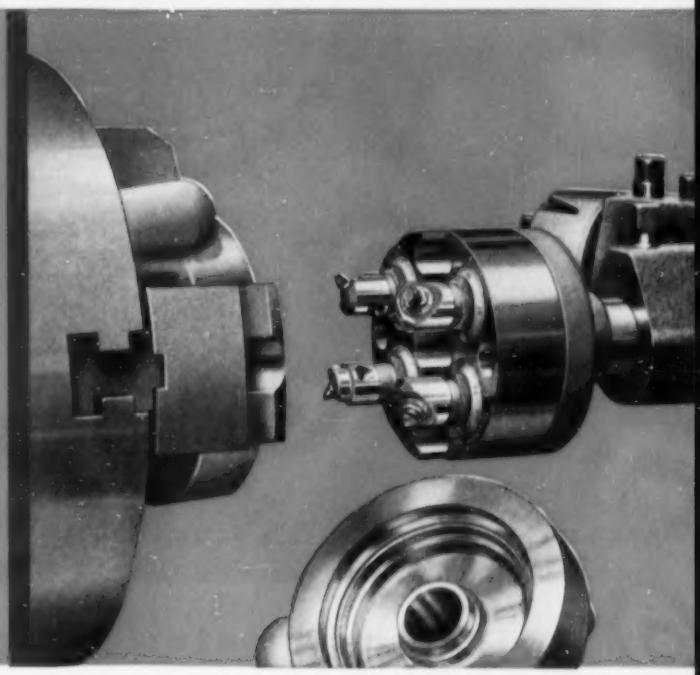
CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through fine distributors from Coast to Coast

13 surfaces finish machined in 2 passes...





HERE'S HOW MICROBORE CLUSTER TOOLING DOES IT ON A TURRET LATHE!

This Special Microbore Production Tooling was designed for a well known hydraulic pump manufacturer to machine pump covers on a turret lathe. Operations include precision boring and turning thirteen diameters and faces in only two passes. Think of the costly manhours saved and down time eliminated in comparison with conventional, piecemeal methods of handling this same job.

ACCURACY IS AN ECONOMY—With the Microbore System of cluster tooling, independent precision adjustment of each Microbore tool point permits accurate settings in a matter of seconds. On piece after piece, machined surfaces are held to extremely fine limits.

Microbore is a versatile tool that can be applied singly or in clusters for all types of boring, turning and facing operations. Microbore also manufactures Standard Boring Bars, Boring Bar Sets and Microbore Flash-Change Tooling—the ultimate for quick change tooling.

Join the leaders who are already multiplying their profits with modern Microbore tooling and methods. Write for Catalog No. 56.

DeVlieg Microbore System

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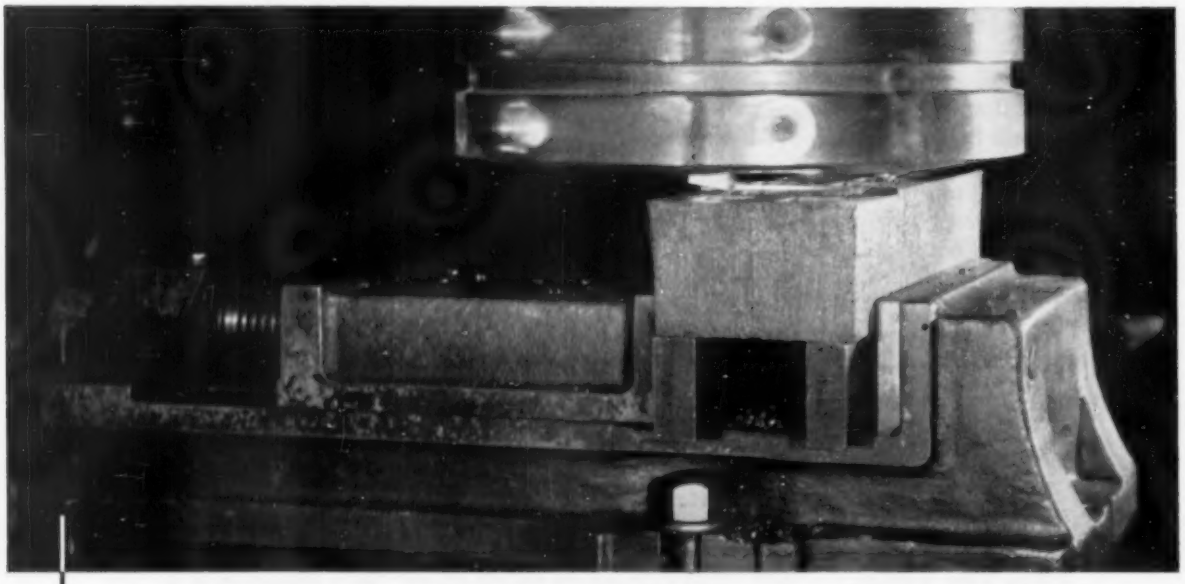
2720 West Fourteen Mile Rd., Royal Oak, Michigan

On any material, any job . . .

INCREASE PRODUCTIVITY, CUT UNIT



Output boosted 20%-30% with Grade 860

Milling gray cast iron. Cemented carbide increased production, yet provided longer tool life, better finishes on the new hard, dense types of gray cast iron. Tests on simulated engine blocks (above) showed Grade 860 took interrupted cuts with minute wear, no chipping . . . while other carbides showed extensive chipping and cratering.

Production rate doubled with Grade 370 tool

Turning 4340 steel. High-impact cutting involved on this special aircraft shaft caused rapid dulling of conventional carbides; several work stoppages per shaft occurred while tools were reground. Today, Synchro Devices, Inc., turns a complete shaft with a single Grade 370 tool . . . also gets double the production.

Daily regrinding ended by Grade 883 cutters

Gang-milling plastics. Cotton-impregnated plastic-like plugboards were so abrasive that steel cutters were down for costly, time-consuming regrinding almost daily. Switching to Carboloy Grade 883, International Business Machines Corp. milled 900,000 boards with the carbide-tipped cutters without sharpening.

COSTS WITH CARBOLOY® CARBIDES

- Take heavier cuts, at faster speeds and feeds
- Lower tool cost per piece, boost machine efficiency

Whether you're cutting steel, cast iron, aluminum—or even nonmetallics like plastics—Carboloy carbide grades will keep machines running longer at top efficiency.

Carboloy cemented carbides make your machines more productive because they take greater speeds and feeds . . . give you more output per grind. And, they'll cut unit costs through lower downtime, grinding, and maintenance costs . . . give you more production per tool. It adds up to a more efficient – and therefore, more profitable – machining operation.

Wide choice of grades

If you're cutting steel, for example, use Carboloy Extra-Performance Grades 350 and 370. These grades have proved their superiority over conventional carbides in hundreds of applications . . . doubling and tripling production in many cases.

If you're milling high-tensile cast irons, there's Carboloy Grade 860. This carbide provides greater resistance to chipping and cratering. Tests show it can increase production 20%-30%.

Or, if you're machining nonferrous materials like aluminum, brass, bronze, or titanium, you can choose from five Carboloy cemented carbides . . . and get the specific cutting characteristics you need for any job from precision finishing to heavy-duty interrupted cuts.

Broad range of products

Carboloy cemented carbides are locally stocked for immediate delivery by 139 Authorized Carboloy Distributors. They're available in the widest choice of styles and sizes in the industry.

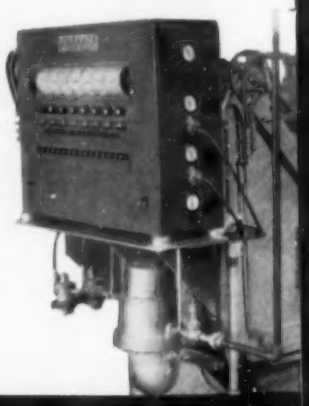
Call your Distributor today (he's listed in the Yellow Pages). Or, send for a copy of Catalog GT-316, containing the new Grade Selection Guide for Carboloy cemented carbides. Write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Ave., Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

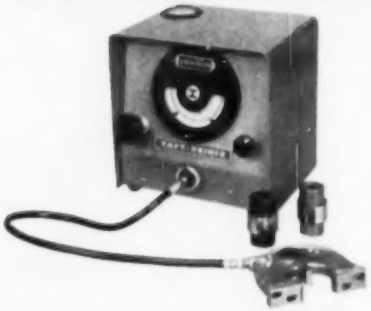
T-P Ingenuity Puts Profit Into Automatic Gaging and Sorting . . . Taft-Peirce Air-Electric Gaging has resulted in a variety of automatic gaging and sorting machine installations. Individual parts are air gaged for size, then dropped into bins marked with size categories. T-P creative engineering makes mass inspection and sorting of parts a profitable reality in your plant.

Taft-Peirce Gaging Stations bring rugged performance plus tight tolerance control to transfer lines . . . T-P equipment handles a multitude of dimensions on a day-in day-out basis, repeating readings without fail. There's one right answer to every automatic or semi-automatic gaging application, so take advantage of specific experience in this specialized field . . . take your problem to the Taft-Peirce Instrument Gage Division.



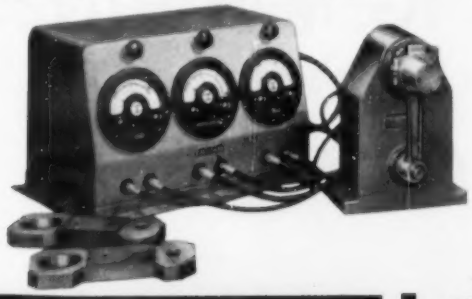
New Versachek Electronic Comparator laboratory accuracy at minimum cost . . . Taft-Peirce provides application versatility plus laboratory precision, priced to appeal to every shop large or small. Four switch-selected graduations: .0005", .0001", .00005", .00001" — all on one dial. Calibration is simple, with 100% linearity over entire scale. Use a Versachek to police wear on shop working gages, for size control beside the machine, or use special output jack with oscilloscopes, ink recorders, and other inspection devices.

New Packaged Control Center For Simplified Feedback Gaging . . . Here's in-process quality control with minimum investment in equipment. Buy this air-electric control unit from stock and apply it to on-the-machine inspection. All accessory fixturing is available from one source — Taft-Peirce — plus whatever application help you need. Use for size control with pass or reject indicated by pilot lights.



New Functional Styling For T-P CompAIRator Air Gages . . . Special slanted face has glare-reducing visor for easier reading under all lighting conditions. Zero and range setting knobs are within easy reach of the inspector. Plus production-tested T-P Velocity-Venturi Air Circuit for exceptional dependability and accuracy. Use the CompAIRator to sort at the bench with instrument-mounted plug, ring, or snap gage, or at the machine with air hose extension.

New! Pass or Reject Parts having related dimensions by one computed reading on one dial . . . Patented Taft-Peirce CompUtair streamlines jobs requiring: (1) check of taper between two diameters, (2) alignment or concentricity of two diameters, (3) squareness of bore to face, (4) center distance without respect to hole size, (5) bend or twist developed during machining. Pass or reject a number of product dimensions simultaneously with one composite reading on one dial. You can't beat the CompUtair for speed and economy on any long-run job.



Look what TAFT-PEIRCE is Doing with INSTRUMENT GAGING

New, Electronic Versachek plus redesigned CompAIRator bring wide versatility, extreme accuracy to quality control.

Like to find new ways to do things? Cut corners? Shave costs? Help your company build a better product?

There's almost always a new way to do it with Taft-Peirce Air Gaging! Engineers are continually finding more opportunities to streamline inspection and quality control with Taft-Peirce Instrument Gaging.

Take advantage of all the "tricks to the trade" in gaging. Consult Taft-Peirce for the most advanced, lowest-cost solutions to your problems.

Get all the Facts . . . from your nearest Taft-Peirce representative or write for Air Gage Bulletin No. 613.

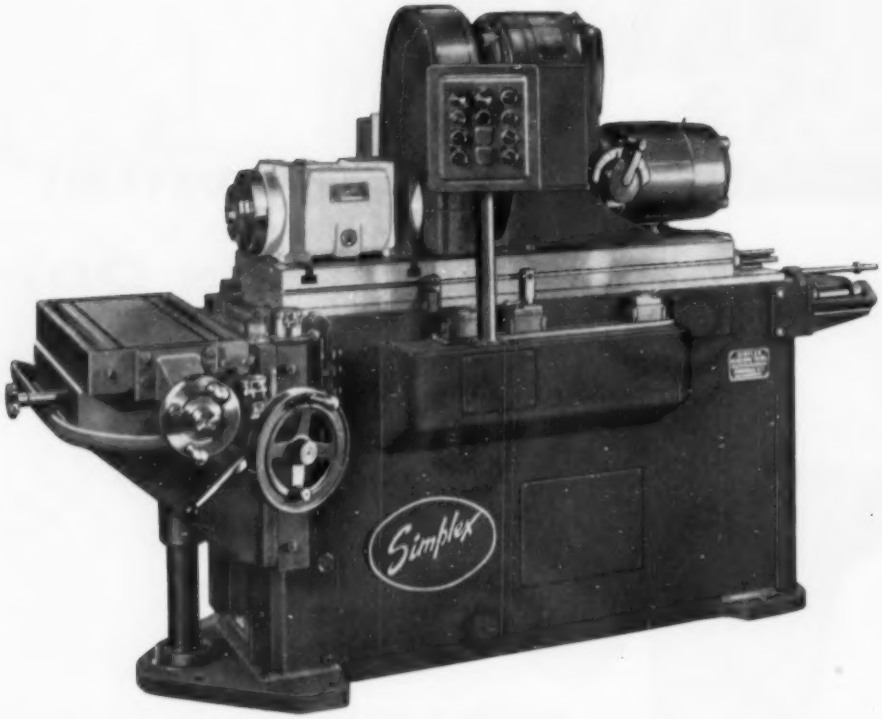
TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, R. I.

T-P Means TOP Precision

Simplex

PRECISION BORING MACHINES



Standard SIMPLEX 2U knee type Precision Boring Machine complete with one #4 SIMPLEX precision boring head and a variable speed drive unit. The longitudinal travel of the table on the knee is 10", which can be actuated either hydraulically or mechanically. The 10" vertical adjustment of the knee is accomplished by use of a hand wheel. The sliding unit table is equipped with turret stops.

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PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
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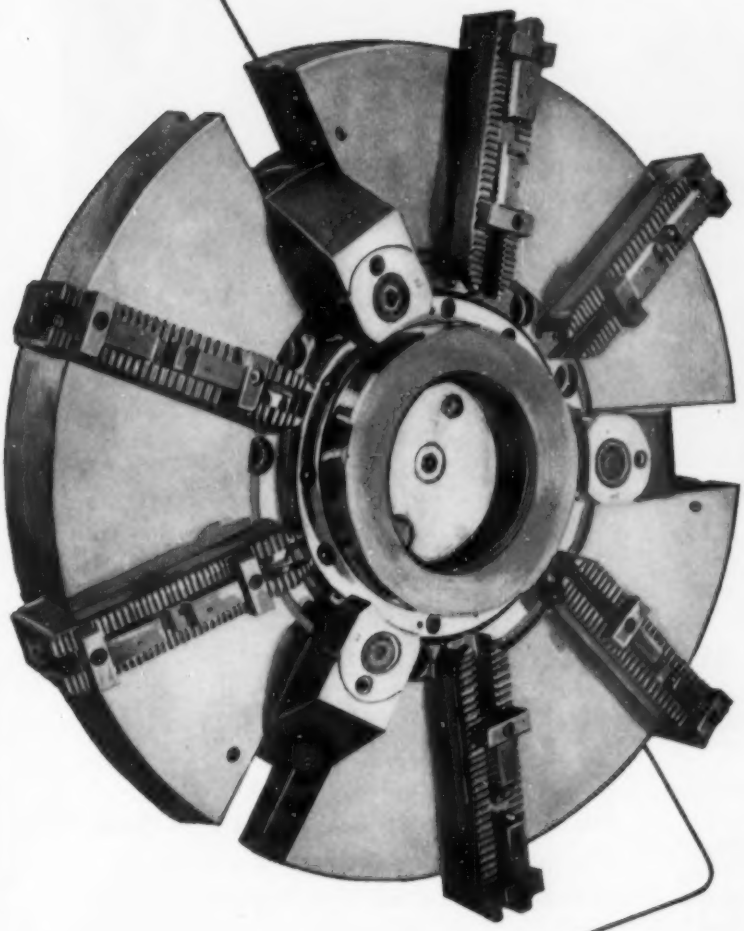
the answer to precision workholding



JET ENGINE CHUCKS

for machining turbine wheels and rings

CUSHMAN CHUCKS GIVE CHUCK-ABILITY—
The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right workholding devices.

CUSHMAN CHUCKS . . . a Product of
American Quality, Labor and Materials

SOLD THROUGH YOUR INDUSTRIAL DISTRIBUTORS

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

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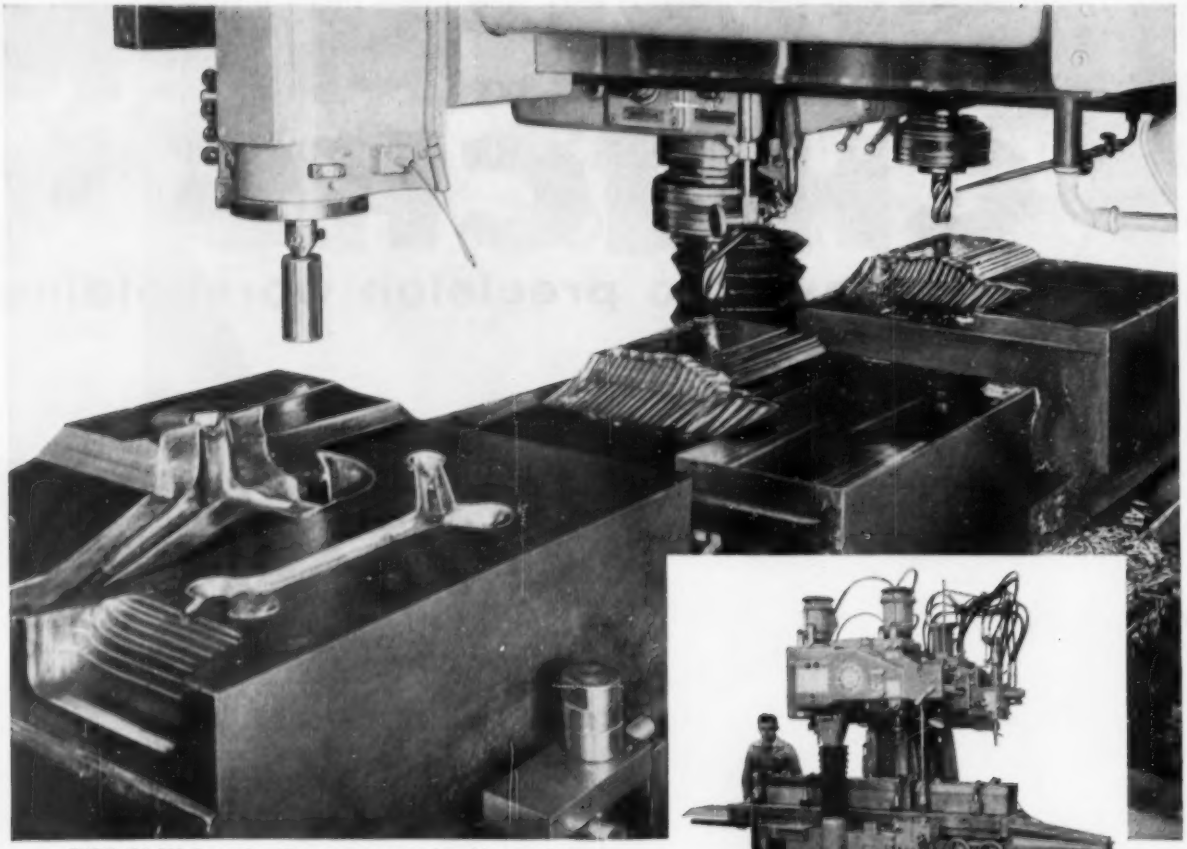
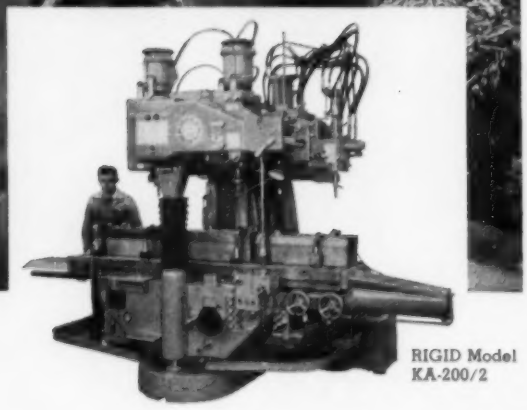


RIGID KA-200/2 rough milling two steering knuckle arm dies



RIGID Model KA-200/2

Rigid *Provides—*

Fully Automatic Die-Sinking Finer Finish, Less Bench Time

A great improvement in accuracy and surface finish—with no increase in cutting time—is possible with these RIGID Die-Sinking and Hydrocopy Milling machines. Fully automatic machining permits a drastic cut in operator's supervision. Accuracy and high surface finish keep bench time to an absolute minimum—in many cases only polishing is necessary. A completely enclosed frame gives the machine tremendous rigidity to handle extremely heavy cuts. The RIGID is available in three sizes with 1, 2, 4 or 6 spindles. Largest copying area is 23⅝" x 39⅞".

OTHER RIGID FEATURES

- Normal Working Accuracy of ±.002" or Closer
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- Hand Control for Roughing
- Reverse Image Attachment
- Automatic 360° Profiler With Depth Control (Working Accuracy ±.002")
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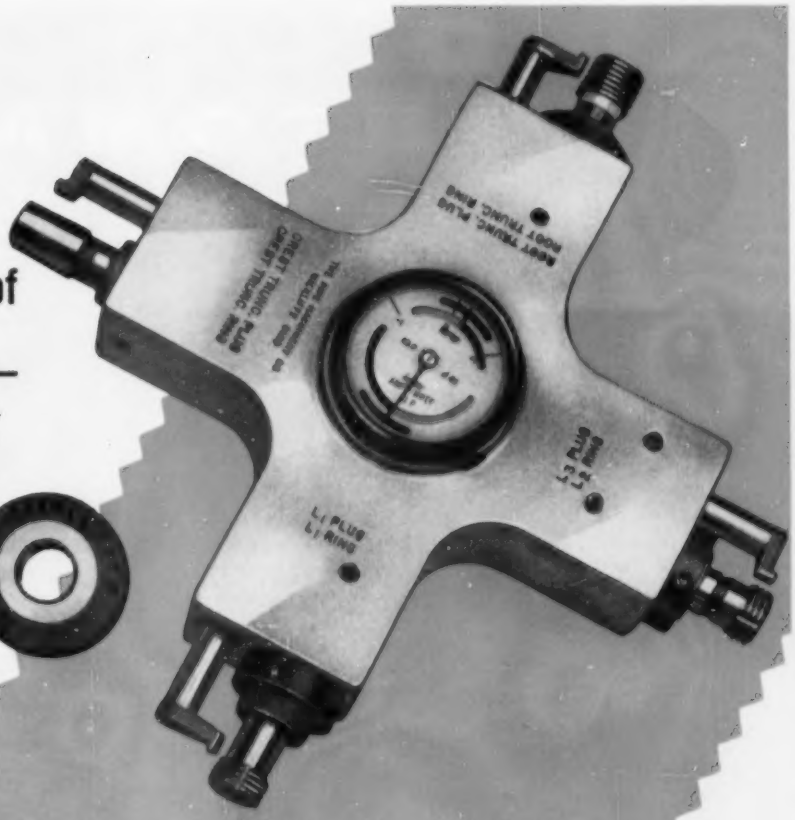
For Accurate Gaging of Precision Pipe Threads—

ANPT, NPTF and NGT



Pipe Machinery Correlchek Gage

Here's What It Does For You!

Inspects fittings as fast as they can be screwed on and off of the individual gages.

NO GUESSWORK ON STANDOFF. THERE IS NOTHING TO REMEMBER—NOTHING TO FIGURE—THE CORRELCHEK DOES IT ALL FOR YOU.

No complicated understanding of gaging required. Check on L-1, set bezel to indicator hand, check with other three gages to appropriate color tolerance zones. It's just that simple.

Wear on gages automatically compensated for by resetting Correlchek to masters.

Standard stock gages are used. You can use the ones you now have in your plant.

Correlchek unit is adaptable for either plugs or rings.

Standard Correlchek units can be used for sizes ⅛" thru ¼" nominal size. (Larger sizes available on request.)

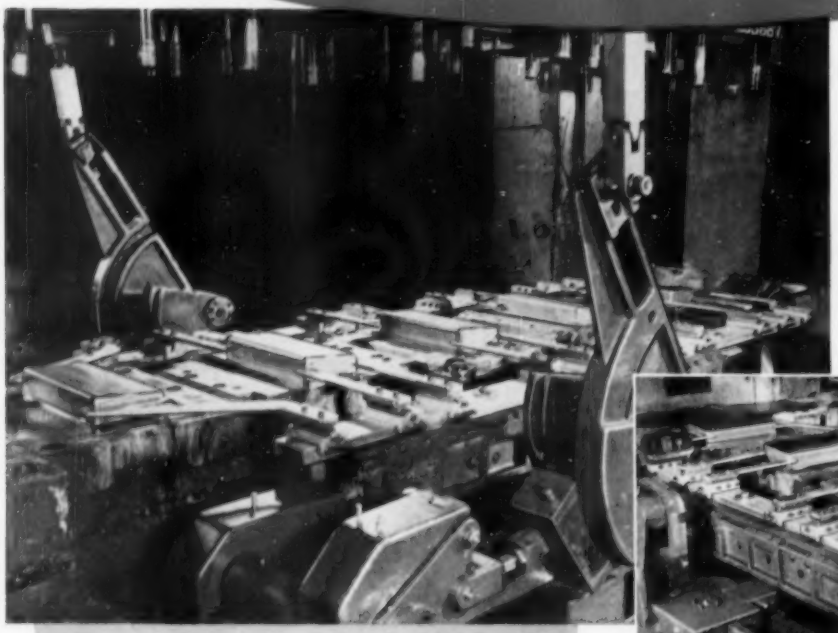
Reduces scrap, reduces leakers, saves time—and discussions. Precise accuracy duplicated every time.

For full details write us on your letterhead.

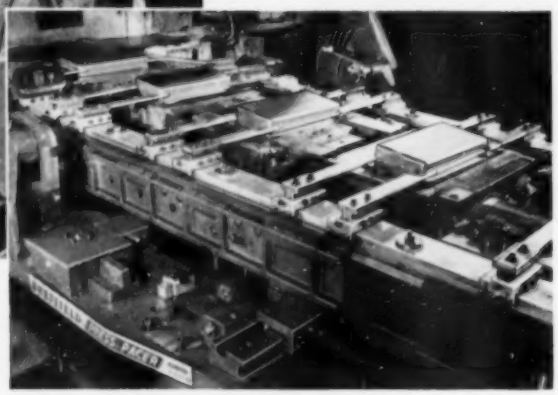
THE
PIPE MACHINERY COMPANY
29100 Lakeland Blvd. • Wickliffe, Ohio

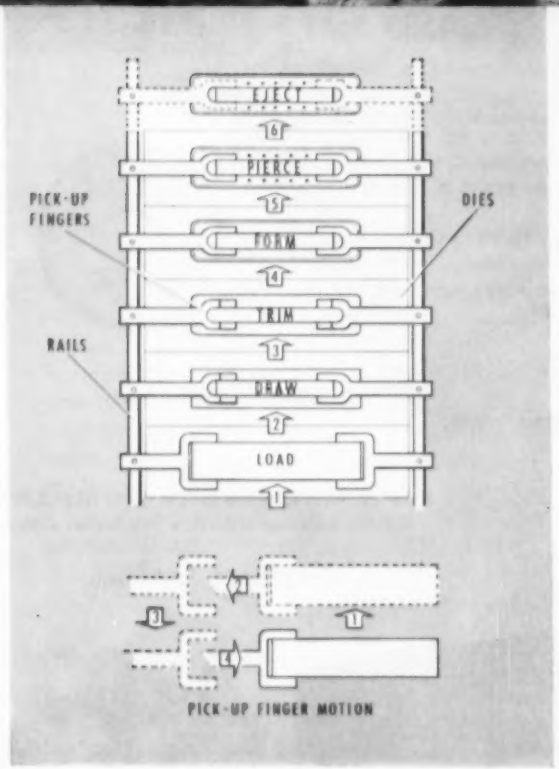
Greater Cleveland

AUTOMATE YOUR PRESS



Automobile oil pan produced from coil stock in six operations on straight side press. Press Pacer automatically transfers stampings from each die station to the next.





The Sheffield Press Pacer is a demountable mechanical transfer device which automates the straight side press while permitting its quick reconversion to conventional operation. It moves stampings from one die position to the next with each stroke of the ram—or from one press to the next.

The Press Pacer is completely mechanical in operation. It is driven by means of a lever arm bolted to the ram. The press so equipped may be fed from front to back or from right to left—loaded and unloaded either automatically or manually.

In a typical installation the Press Pacer enabled one press to handle three times the production previously turned out by six presses. In addition it eliminated work damage caused by moving parts from press to press.

WITHOUT RESTRICTING ITS USE TO ONE PRODUCT BY MEANS OF THE

SHEFFIELD PRESS PACER

Press Pacer automatically moves these torque tube flange stampings through 6 die stations on this large press.

COMPLETE FLEXIBILITY

The Press Pacer can be installed in a few hours. If any emergency makes manual feeding imperative, the Press Pacer may be demounted within minutes and the press operated in conventional fashion.

The Standard Press Pacer is built for presses with a bed area of 42" x 72" **or larger**, and a shut height of 14" **or more**—special units for smaller and larger presses.

Feed distance between dies for the **standard** unit may be varied between 8" and 36". Stroke adjustment has a range of 12".

Feed fingers and other elements may be readily revised to accommodate product changes.

Before deciding on a change in your press equipment, find out how much a Press Pacer would save you.

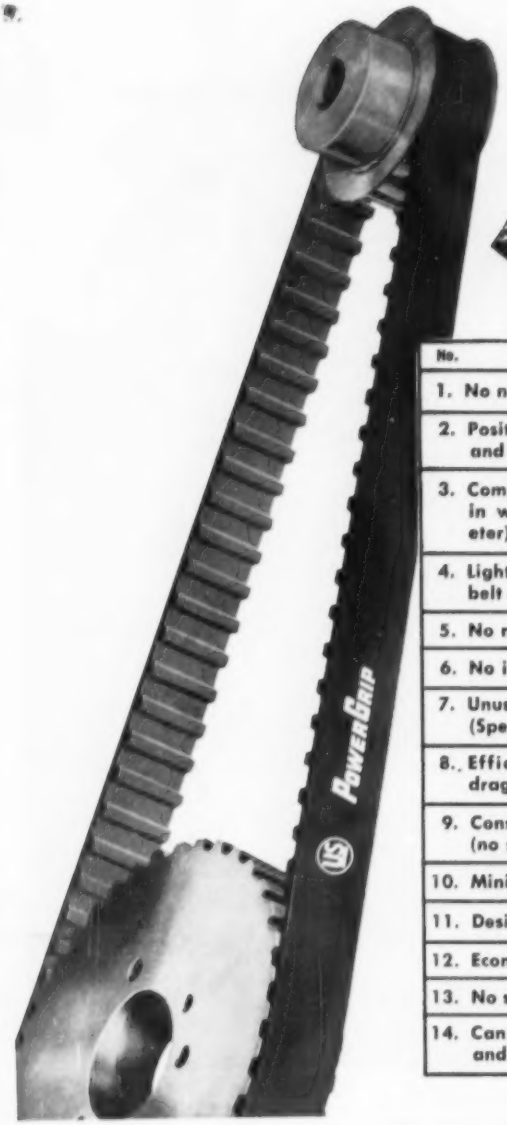
Send your part prints, press information and production requirements to ***The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 19.***

*Trade-Mark

the SHEFFIELD corporation

measurement for mankind

7721R



"√" in your transmission belt needs

No. Advantages	PowerGrip "Timing" Belt	Chain	Gear	V-Belts	Flat Belts
1. No need for lubrication	√				
2. Positive elimination of slip and creep	√				
3. Completely compact (Both in width and pulley diameter)	√				
4. Lightweight (Heavy duty belt only 0.1 lb./ft./in.)	√				
5. No noise or vibration	√				
6. No initial tension	√				
7. Unusual speed range (Speeds up to 12,000 FPM)	√				
8. Efficient (Elim. heat, lube drag, high bearing loads)	√				
9. Constant angular velocity (no speed fluctuation)	√				
10. Minimum backlash	√				
11. Design flexibility	√				
12. Economical	√				
13. No stretch	√				
14. Can it be completely housed and forgotten?	√				

Note that the U. S. PowerGrip "Timing" Belt takes a "√" after every advantage

While every type of drive has certain advantages, *no* type of power transmission possesses *so many* advantages as the U.S. PowerGrip "Timing" Belt drive. For example, *it is the only positive drive that never needs lubrication.*

THE LIST OF USES GROWS DAY BY DAY! Power production machinery in every field is made more efficient, volume of production increased, and maintenance costs lowered with this amazing belt. The list of OEM applications grows too numerous to mention. U.S. PowerGrip has streamlined hundreds of products... made them sell above competition. Some equipment would not be in existence at all, if it weren't for this great belt.

U. S. PowerGrip "Timing" Belt drives—from flea-power to 1000 h.p., and with ratios up to 12 to 1—are obtainable at any of the 28 "U. S." District Sales Offices, at selected "U. S." distributors, or by contacting us at Rockefeller Center, New York 20, New York. In Canada, Dominion Rubber Co., Ltd.

Send for free illustrated manual, complete with standard drive tables.

Mechanical Goods Division

United States Rubber

SETTING "STANDARDS" FOR TOMORROWS CUTTERS!

Brown & Sharpe — NELCO *A Tremendous Tooling Team!*

PRODUCTION SERVICE—
Now, the largest line of "standard" Solid Carbide, Carbide Tipped and High Speed Steel Milling Cutters is available to America's metalworking plants without wait, worry, waste or downtime! It's a fact—more than 3000 stocked "standards" eliminate the need for most expensive "special" tools.

DISTRIBUTORS' STOCKS—
Every Brown & Sharpe-NELCO Distributor stocks for prompt service wherever you are. Over 2300 "standard" Brown & Sharpe High Speed Steel Tools and over 700 "standard" NELCO Solid Carbide and Carbide Tipped Tools are available to answer over 90% of milling problems. Speedy service on "specials" is also available when necessary—specials engineered by a Tooling Team with over 140 years of metalworking experience.

FIRST IN TOOLING—
Galloping competition in industry today makes it vital that new improved machine tools be equipped with the *best* in tooling. The tool is the payoff-point of every machining operation, whether on new, modern equipment, or old. Precision production, machining speed, product delivery, product quality—all depend on the excellence of the tooling used in production. When it's Brown & Sharpe-NELCO Tooling, the result adds up to Profits, Growth and Prosperity.

ADVANCED DESIGN—ENGINEERING—
Not only the largest milling cutter line in the world, but the most expertly engineered tools are available. Brown & Sharpe-NELCO, pioneers in the tooling field, have constantly led the tooling industry with new designs and inovations that have today become industry standard. You can be sure—if it's good tooling practice—you will get it from your Brown & Sharpe-NELCO Tooling Team FIRST!

CALL YOUR DISTRIBUTOR—
Keep a copy of the 50 page NELCO Catalog C-14A and a copy of the Brown & Sharpe Cutter Catalog handy. They are your reference to speedy service on over 3,000 "standard" Carbide Tipped and High Speed Steel Milling Cutters. Your local distributor will "jump" the minute you call. Remember: because they are *best*, they are also the *easiest* to buy!

PRODUCTION RECORDS
No wonder users of th... breaking production ... are *up*—down time is w... —waiting is p... liveries are ... and product ... Sharpe-Nelc... re... tooling engineers wh... shoot production problems in ... customer's plant give off-the-shelf delivery ... complete line of Mill... today!

SALES RECORD
Brown & Sharpe ... NEL... Carbide ... Tool... initely repre... *largest grow...* ...te of cutters in the world! The ... for this growth rec... that ... largest ... of cutte... best ... cutt... engineered are a... easie... to get.

WHICH TOOL TO ...E?
With over 2300 Brown & Sharpe High Speed Steel Cutters a... NELCO Carbide T... available through ... and service orga... to use" is neve... No... tisan sales recom... ways available— right job is always as... phone—and expert attention t... your individual probl... guarantee ... lutions to th... ilt tooling problems.

...fy Brown & Sharpe-NELCO— It ... profitable thing ... you'll ... e glad you ...

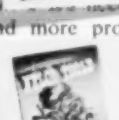
...TIPP... ...Mills, ...Slitting ...Side Mills, ...Adapter... ...yseat ...tters, Dia... ...nd Wheels... ...ll End... Mills, Tri-... ...x Face-M... Grinds, ...and Lathe ...i-H... Side ...lling Cut... ...e T... ...d End... Mills, Solid ...d ... and ...ell Milling ...ors.

...D STEEL TOO...—
...n & Sha... NELCO Dis... ...cks:
High Spee... ...g Cut... ters, Coars... ...ters, Helical M... ...de Milling ... ...ut... ters, F... End Mills, ... Shell End Mi... ...yseat Cutters, A... Slot... ...ng Cutters, ... Spur Gear ...rs, Cutter ...ers, Cam Lock ... Cutter Adapters, Chuck Adapters and Spring Chucks.

S... RECO...
Servi... on more t... 000 different, standard stocked tool... ast around the corner fr... everyw... One of ... largest c... ating org... tions backed up by q... d tooling ... neers wh... ouble... production problems i... custo... plant give of... shelf de... on the ... com... plete ... of Milli... utters available today!

SEND TODAY FOR 80 PAGE CUTTER CATALOG "BROWN & SHARPE MILLING CUTTERS!"

Brown & Sharpe
BROWN & SHARPE MANUFACTURING CO.
PROVIDENCE 1, RHODE ISLAND



SEND TODAY FOR 50 PAGE CATALOG C-14A "NELCO CARBIDE TIPPED TOOLS!"

NELCO TOOLS
NELCO TOOL COMPANY, INC.
MANCHESTER, CONNECTICUT

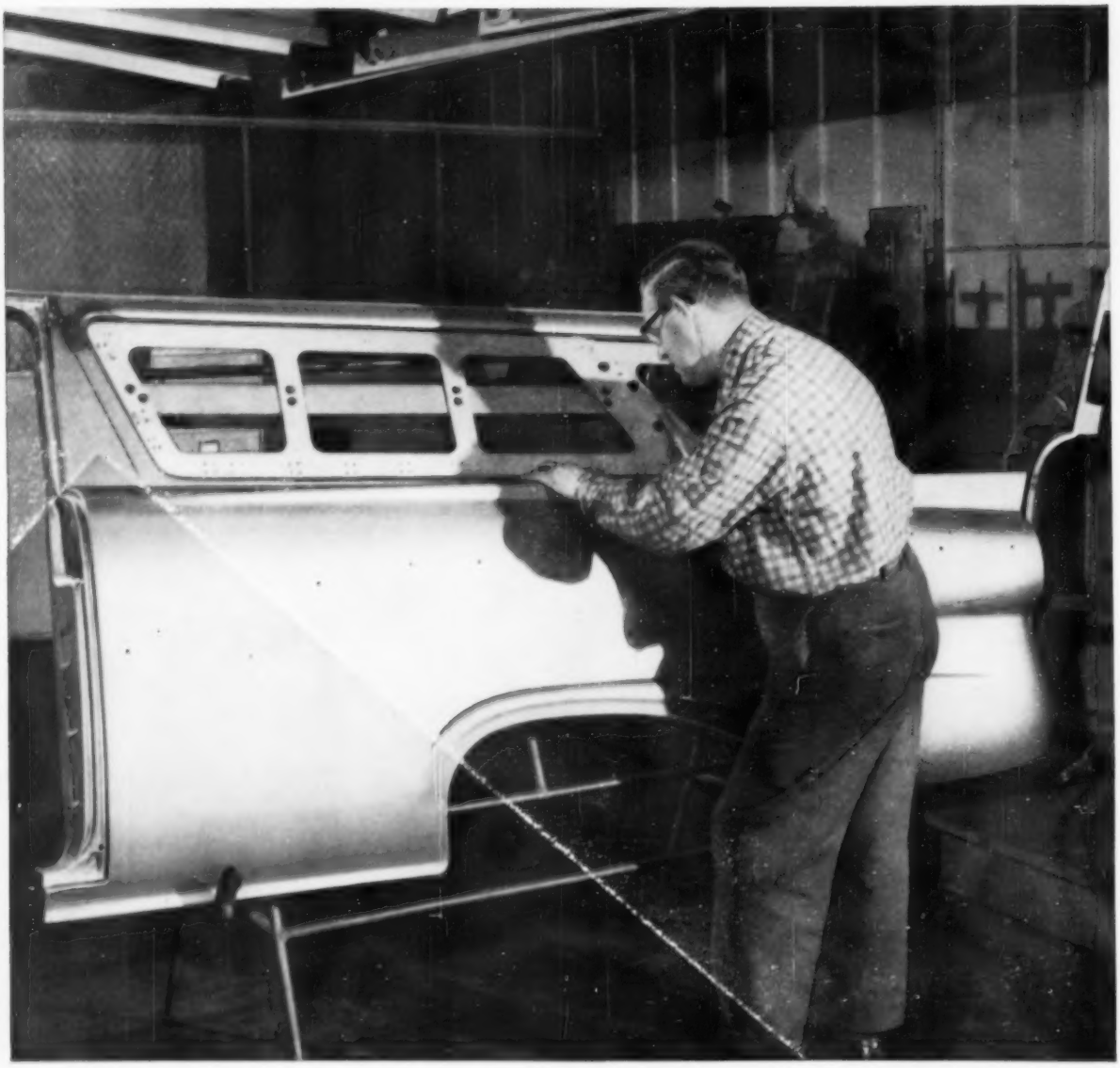
...of cutters—the ...best milling cutters engine... ...lay are also ...

...gh ...90 ...ll ...28

...ation—"which tool ...to use" is never a problem. Non-partisan sales recommendations are always available.

...tooling. You will be days and days ahead when you

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A—6—53.



Lightweight magnesium fixture checks Ford station wagons

This magnesium checking fixture is used by Ford Motor Company in assembling Ford two-door station wagons.

It helps to maintain quality by checking the daylight opening relationship to the glass run channel and regulator retainer brackets in the quarter panel welded assembly. It assures accurate location of the glass run retainers and window regulator mounting holes. The fixture is dimensionally stable and has stood up well under continuous rough handling. One man can easily lift and manipulate it with one hand.

Jigs and fixtures made with magnesium are always easy to handle because they weigh much less than steel or aluminum. Magnesium tooling plate is uniformly flat, low in cost and easy to machine, fabricate and weld.

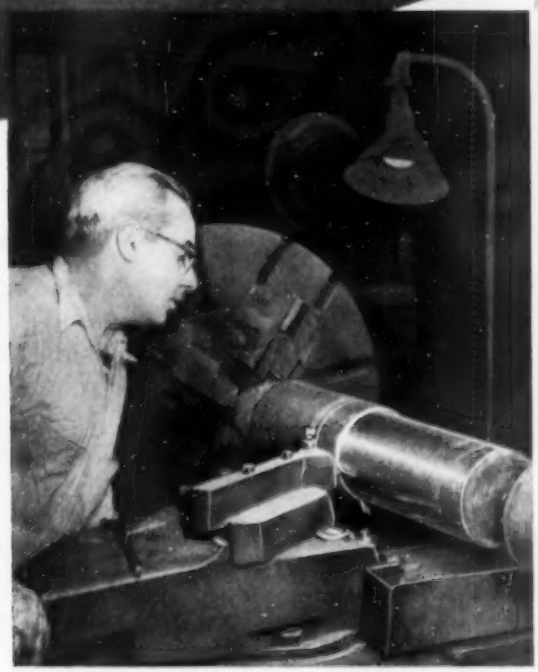
For the full story on magnesium tooling plate contact your nearest supplier of Dow magnesium or write to us.

THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1416U-1.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

HAYNES Alloys solve the *tough* machining problems

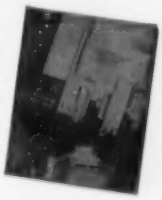


Removing metal fast from hard alloys— HAYNES STELLITE alloy tool removes surface imperfections from a hard chromium-nickel ingot. The 98M2 tool is the only one that will handle this machining job successfully.

Biting off a pound of tough alloy per minute

It takes an unusual tool bit to survive the impact of a deep cut when machining rough alloy billets—and still retain a sharp cutting edge while operating at red-heat temperatures.

Yet HAYNES STELLITE alloy tools handle these jobs in stride. At one plant, for example, they have been the standard tool material for the past 10 years machining 6-inch diameter chromium-nickel billets—a particularly rugged operation. A 98M2 tool completely machines 2½-foot long billets, making cuts that range up to ½ in. deep.



For more information, write for our *Metal-Cutting Tool Manual.*

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles
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HAYNES TRADE-MARK ALLOYS

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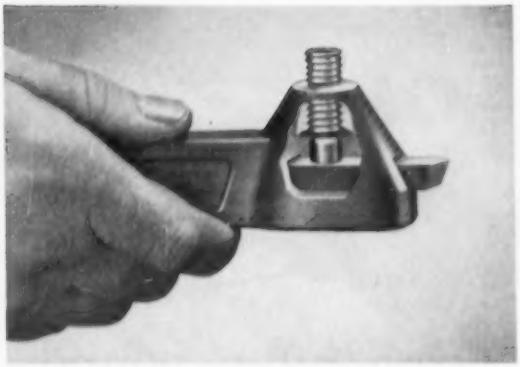
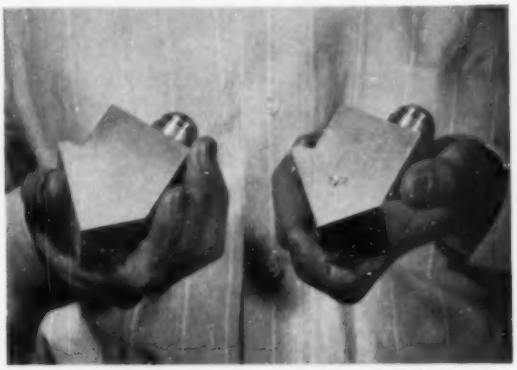
Practical Tooling Tips

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

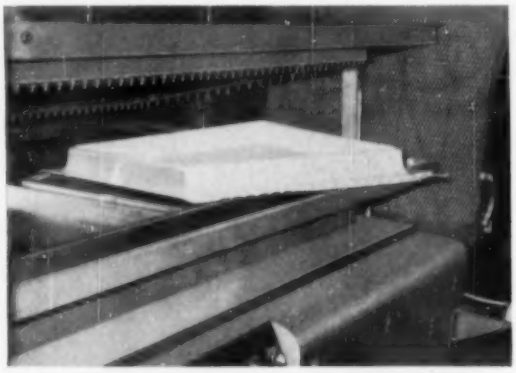


TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

New catalog now ready! Send for your copy today.

Insist on Vlier Tooling Specialties... there's still no substitute for quality.

VLIER ENGINEERING INCORPORATED

8900 Santa Monica Blvd., Los Angeles 46, California

Here's

"What's NEW!

with SIMONDS ABRASIVE CO.

GRINDING WHEELS

NEW

IL BOND . . . for longer, faster, heavy-duty grinding

New IL Bond . . . it's in the grinding wheel mix. Special chemicals and compounds added to conventional resinoid bonds provide an *internal lubricant* to increase cutting action and prolong grinding wheel life. For ALL your snagging jobs!

NEW

DA Borolon® TRADE MARK . . . abrasive for resinoid bonded snagging wheels

New DA Borolon . . . an improved, smaller crystal aluminum oxide abrasive for resinoid snagging wheels for floor stand and swing frame grinders . . . has more and sharper cutting edges, gives more production. Use with IL Bond described above.

NEW

SA Borolon® TRADE MARK . . . abrasive for toolroom grinding wheels

New SA Borolon . . . a radically different, friable aluminum oxide abrasive with a unique *single* crystal formation that gives cooler, faster grinding and longer life. Ideal for tool and cutter grinding and horizontal surface grinding.

Send for descriptive catalog bulletins on these new products. Ask for IL, DA or SA bulletins.

SIMONDS ABRASIVE COMPANY

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCHES: PHILADELPHIA • CHICAGO • DETROIT • LOS ANGELES
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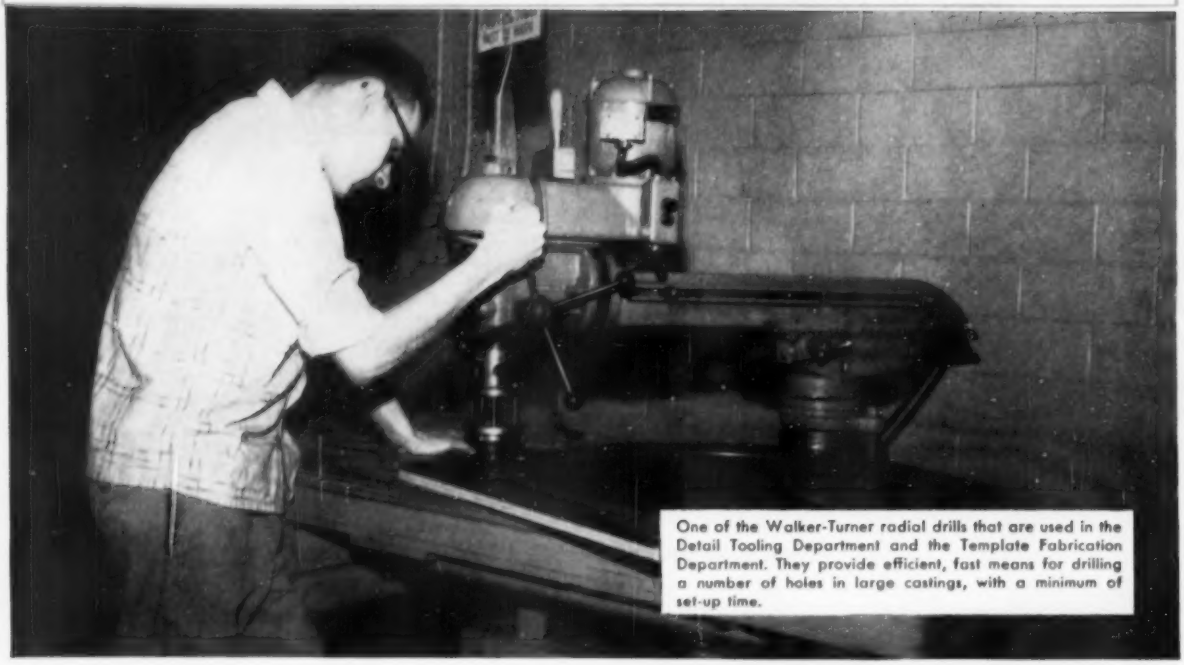
INDUSTRY REPORTS ON WALKER-TURNER



One of the Walker-Turner radial drills that are used in the Detail Tooling Department and the Template Fabrication Department. They provide efficient, fast means for drilling a number of holes in large castings, with a minimum of set-up time.

At North American Aviation, Columbus, O.

WALKER-TURNER RADIAL DRILLS IN CONSTANT USE FOR 6 YEARS — AND STILL GOING STRONG!

In the Template Fabrication Department of North American Aviation, two W-T radial drill presses are utilized in a production-line operation for making all router jigs. *These two Walker-Turner units have been in constant use for six years... and have been overhauled only twice.*

In this set-up, positioning holes are drilled in the jig on the first press. Then the work is passed on to the second Walker-Turner radial drill, where the operator drills or countersinks the holes as necessary. It's fast, efficient and convenient.

The Company has found the versatility, rugged construction, and low maintenance of other Walker-Turner "Light-Heavyweights" also make them ideal for many tooling and production jobs in other departments.

Now—A New, Improved Walker-Turner Radial Drill Press

that's even stronger, more versatile, easier to operate.

walker-turner

With its all-new, heavy-duty head assembly, the improved Walker-Turner radial drill press offers all the ruggedness, versatility and efficiency of larger machine tools costing several times as much.

Ask your W-T distributor to demonstrate the many outstanding features of this new line of "Light-Heavyweights." He's listed under "Tools" in your telephone directory. Or write for his name and literature.

WALKER-TURNER
Division of Rockwell Manufacturing Co.
Dept. WF-25, 400 N. Lexington Ave., Pittsburgh 8, Pa.

Available in 24 models with either 4¼" or 6" spindle travel.

Here are the world's finest power cylinders

...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

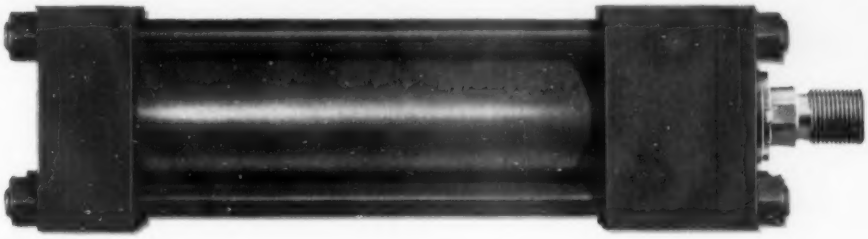
He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life ...accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

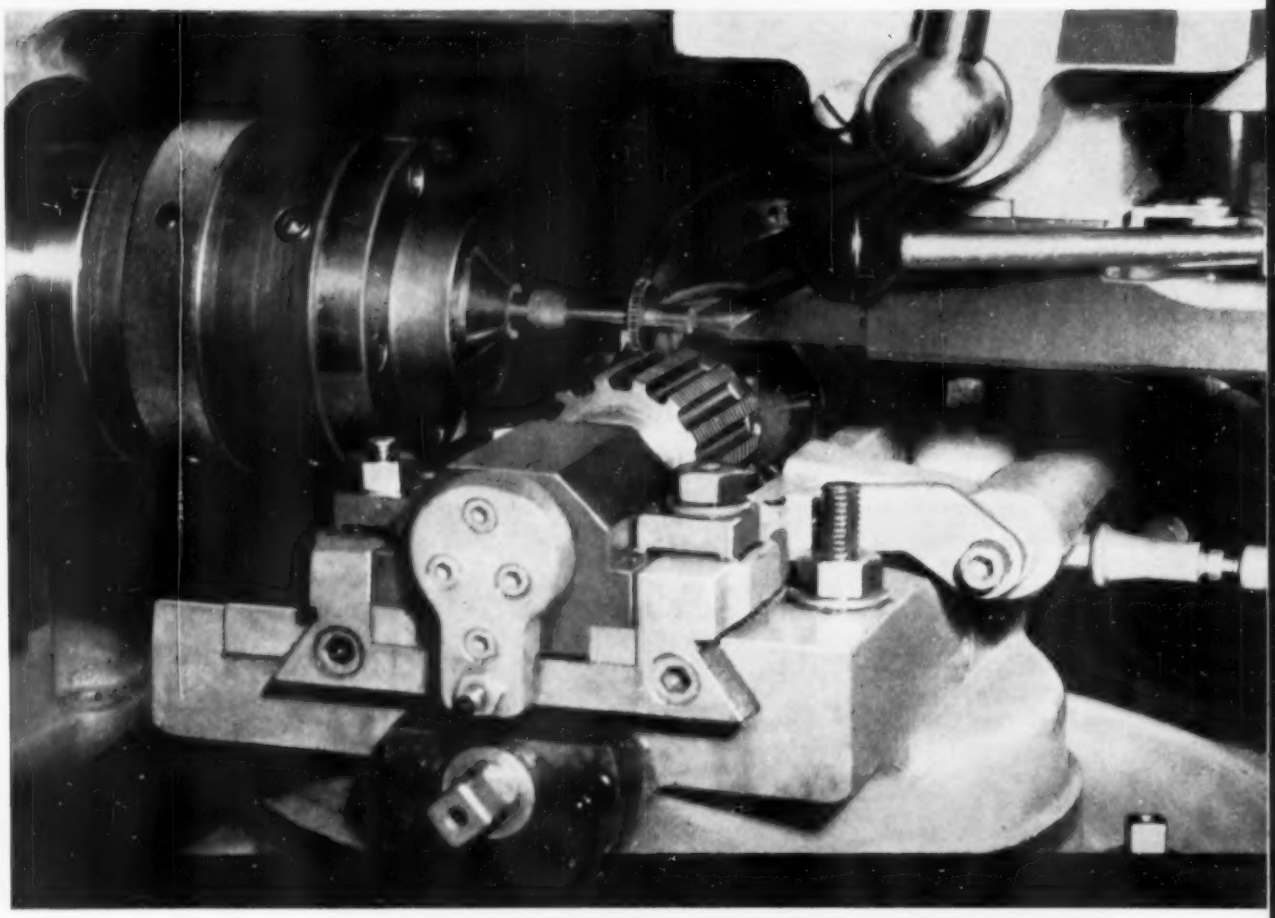


COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Ill.

HOBBING PRECISION GEARS

within precision Class 2 AGMA tolerances.....



Fine-pitch instrument gears are cut on Barber-Colman Precision No. 6-10 Hobbing Machines at Belock Instrument Corporation. For their most accurate gears, Belock uses Barber-Colman Class AA hobs exclusively.

with standard-type precision hobbing machines

The Belock Instrument Corporation manufactures complex electronic and electromechanical systems and components. The constant demand placed on them for greater accuracy in these instruments requires all gears to be cut to very close tolerances and yet be completed on a practical production basis.

Belock hobs such gears consistently within Precision Class 2 AGMA tolerances, using a battery of *standard-type* Barber-Colman Precision No. 6-10 hobbing machines. These are unusually close tolerances and the use of *standard-type machines* for these gear accuracies is a good reason for taking a close look at the elements and methods they employ.

here's how they do it:

Gear blanks are machined to Precision AGMA tolerances. Then, for maximum accuracy in hobbing all precision gears, Barber-Colman Class AA single-thread ground hobs are used. These hobs are manufactured with tapered bores, since taper-bore hobs can, with greater ease, be mounted more accurately on the hob arbor to eliminate runout. These hobs are resharpened to original class AA accuracy using a Barber-Colman No. 6-5 Hob Sharpening Machine.

The gears are finish-hobbed on Barber-Colman Precision No. 6-10 Hobbing Machines. These machines hold a precision relationship between the rotation of the work and the rotation of the hob which allows them to consistently hob gears to these fine tolerances.

Barber-Colman Precision No. 6-10 Hobbing Machines are built with large precision index worm gears and single-thread worms for maximum tooth spacing accuracy. All vital machine parts are specially selected for close tolerances.

If you have a problem of producing consistent accuracy in gear cutting, consult Barber-Colman Hobbing Engineers for assistance. They can help you obtain any class of accuracy you desire with the most practical equipment for doing it.

this is an actual production record:

GEAR	HOB	OPERATION
Diametrical Pitch — 64	Class AA Ultra-Precision	Feed — .015"/rev.
Pressure Angle — 20°	2" Diameter, Taper Bore	Speed — 120 sfm
Outside Diameter — .7812"	Pieces per Sharpening — 720	
Pitch Diameter — .7500"	Stock Removal per Sharpening — .005"	
Face Width — .093"		
Material — 303 Stainless, 30-35 RC		

BARBER-COLMAN COMPANY

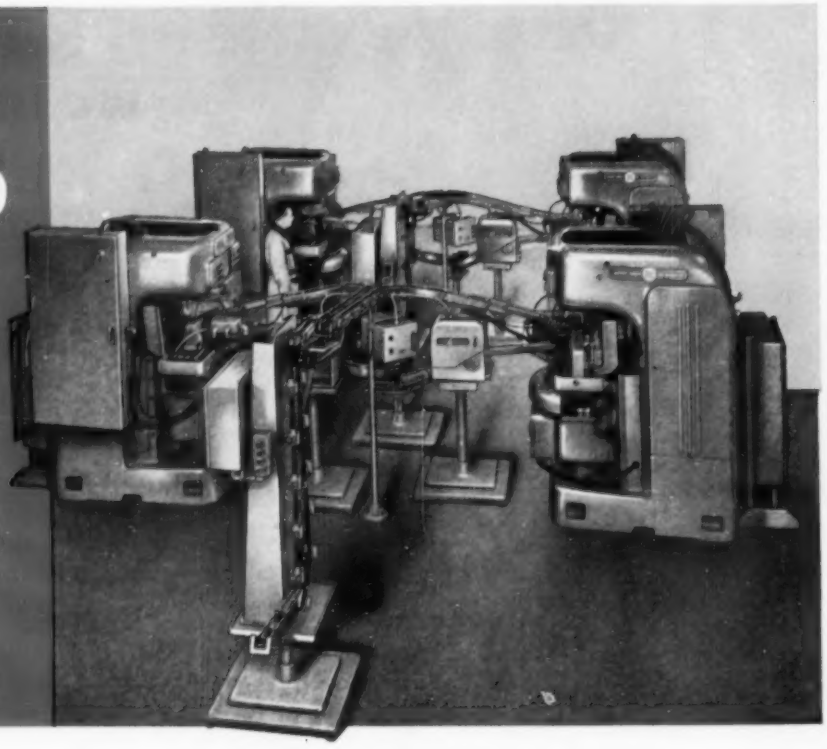
686 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

FULLY AUTOMATED GEAR SHAVING

CAN ALSO BE PERFECTLY FLEXIBLE



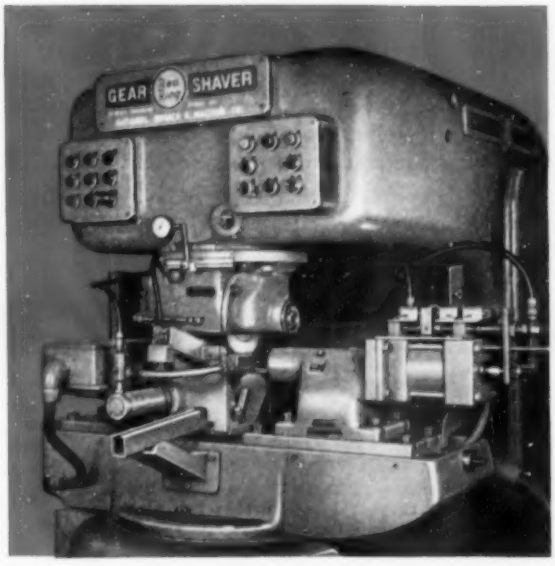
This fully automated installation shaves the split long pinion used in automatic transmissions. This pinion consists of two gear sections each of which is individually crown shaved. Output at full efficiency is 400 pinions (800 gear sections per hour).

The first pair of standard Red Ring Shaving machines processes one of the pinion sections. The second pair processes the other.

Automatic sizing gages perform a 100% check and reject any out-of-tolerance units.

Any individual shaving machine may be stopped at any time for cutter change or adjustment without interferring with the operation of the rest of the system. This is provided for by automatic switching in the feeder lines.

The flexibility of the supply and discharge lines greatly facilitate positioning the machines.



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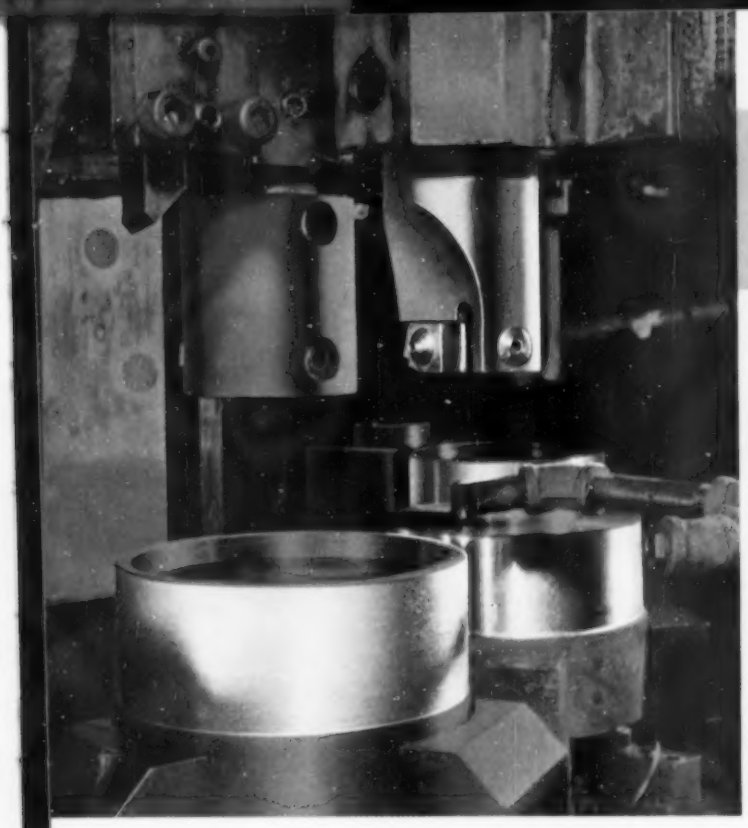


TOOL NEWS

carbide

Throw-away inserts in micro-adjustable tools drop costs from $4.50 per 1000 pieces to 43¢

WESSON Boring Bars Cut Turning Costs

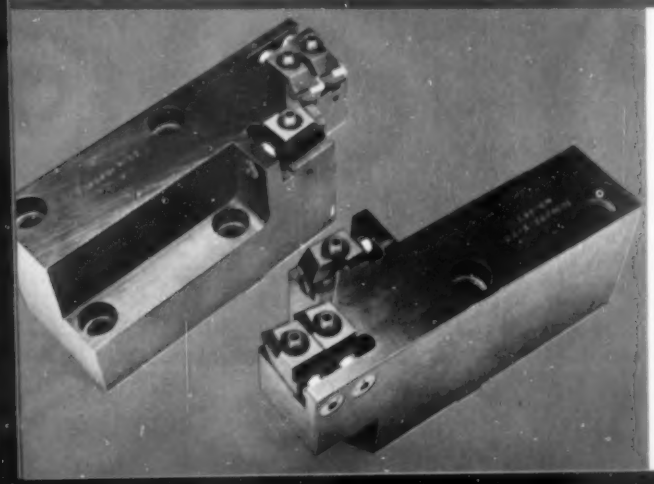
Replacing conventional single point tools, Wesson-metal throw-away inserts in micro-adjustable **WESSON** boring bars are showing the following savings on a planet carrier housing turning operation:

Tool grinding eliminated
Tool cost cut from $4.50 to 43¢ per 1000 pieces
Tool-change down-time cut 93%
Tool re-setting after sharpening eliminated
Pieces per tool change almost doubled

Since the only change in the tooling, when dull, is to index the insert or replace it after 8 indexes, no tool-change-adjustment is required after the first setup. The latter is quick and positive because of the micro-adjustment feature (0.001 inches per graduation on the screw head).

Again, therefore, **WESSON** insert tooling demonstrates the ability to slash the really important tool costs—those hidden costs in tool grinding, down time, etc.—which usually far outweigh initial tool cost. The reduction in initial cost in this case was only 4 cents per 1000 pieces. The "upkeep" cost, however, was slashed $4.00 per 1000 pieces . . . without even figuring in the eliminated down time.

For data on these tools ask for Bulletin #MB-157.



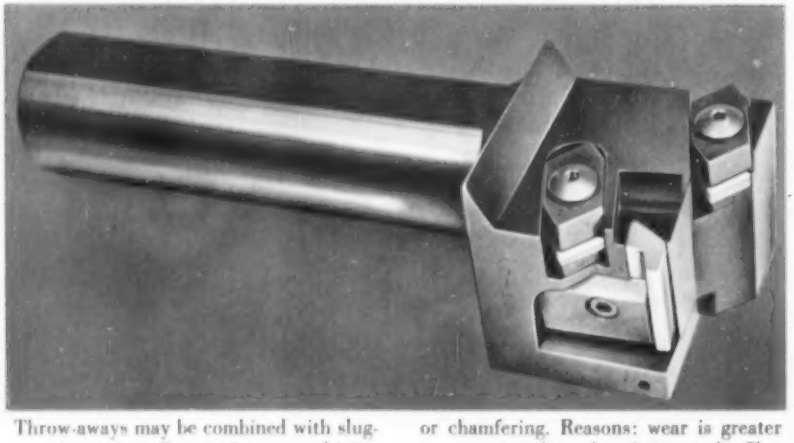
Tool Blocks for Throw-Aways are Micro-Adjustable

The **WESSON** tool blocks shown here are used to rough and finish turn and face transmission parts on an Ex-Cell-O two-spindle machine. Micro-adjustment permits rapid setup, each division on the calibrated screwhead being equal to 0.001 inch. The square inserts provide eight cutting edges, high production per insert, and low tool cost.

Throw-Aways for More New Uses

These three special tools perform a combined total of some 10 operations. The 4-tooth cutter in the rear is for counterboring. Its 4 teeth are micro-adjustable for diameter, the screw head being graduated in 0.001 inches of movement. Quill in the foreground is used for facing, forming a step, counterboring, grooving and chamfering. Tool at the right is used for combination of internal and external operations: turning two OD's, facing and counterboring. All have these features in common: They are designed to use Wessonmetal throw-away inserts; they are rapidly set up; they cut down-time for tool changing to a minimum; they eliminate all tool grinding; and they greatly reduce tool costs per piece produced.

Both Throw-Away and Slug-Type Inserts Used in Tool Holders



Throw-aways may be combined with slug-type inserts to effect optimum machining efficiency and economy. For instance, use of both slug type (on-end) inserts and throw-away types in the same tool holder is recommended where grooving is to be combined with such operations as turning or chamfering. Reasons: wear is greater on grooving than chamfering tools. Slug type insert can be quickly re-ground. Special throw-away insert for this use could not be indexed and would be too costly. Shown here is a typical tool holder with both types of inserts.

tools Wesson carbide Wessonmetal

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Ideas in Throw-Away Insert Micro-Adjustable Tools

Get our Bulletin #MB-157

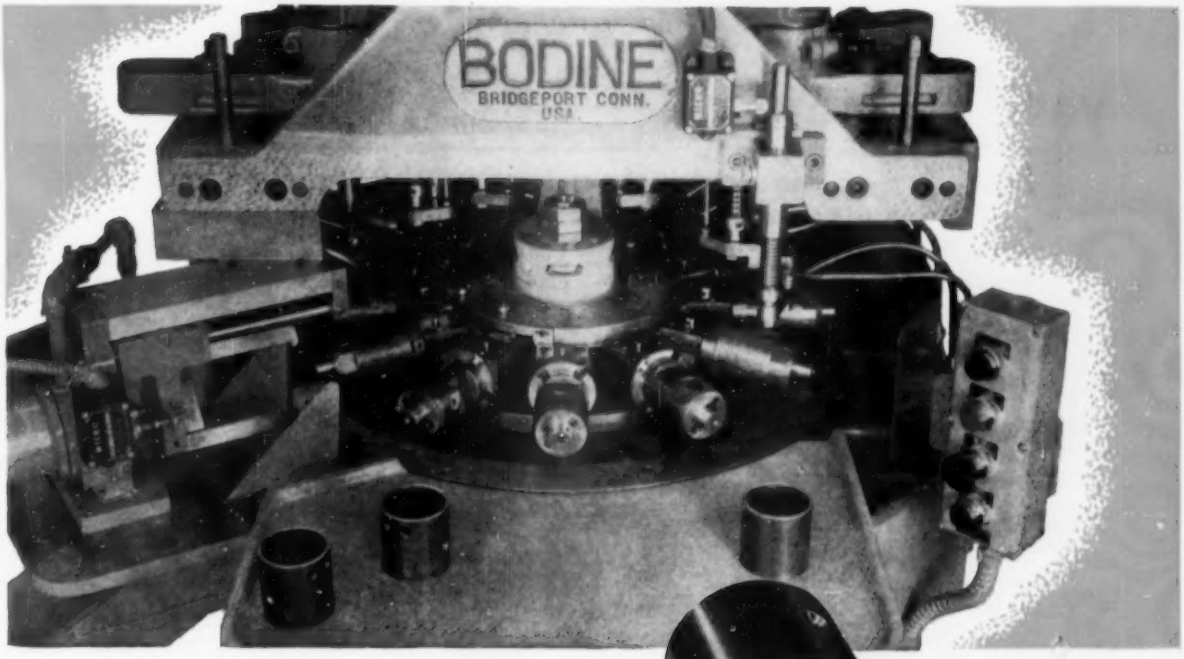
You'll find it valuable in planning for the retooling of turret lathe operations on which you want to cut tool costs per piece and down-time for tool changes. Also gives specifications and prices, shows standard replacement parts, 15 line drawings.

Bulletin #PG-157

Get this bulletin. It will tell you how to cut your grinding costs on carbide tools, how to get greater diamond wheel life; how to boost grinder output per hour from 30% to 50%; how unskilled operators can get better tool finishes than skilled operators on other grinders; how to cut tool regrind cost almost in half.

LITHO IN U.S.A.

Bodine case history no. 44



1. Drill and countersink
2. Drill
3. Drill
4. Drill and countersink
5. Ejects stripping inside burr

here's how the automakers streamlined small motor production on BODINES

This Bodine Case History is really only one of many closely related installations in the key auto-electrical plants. The fact is that essentially ALL the small motors that power windshield wipers, window lifts, heaters, seat adjusters, etc., on today's cars are made this way . . . and on Bodine machines.

Parts being made on this 42-30 Bodine are tubular motor frames. On the production line, tube sections are conveyor-fed and held as shown on horizontal automatic indexing fixtures. After machining, they are automatically ejected by the stripper mechanism shown at the left of the machine, while special carbide inserts designed into the fixture remove inside burrs.

In the photograph above, auto-loading conveyor and locking mechanisms have been removed to show tooling.

Simple, rugged Bodine VERTICAL tool spindles drill and countersink two holes and drill two additional holes through the walls of the tubing, as shown in the diagram . . . all accurate within close limits for position and angularity. The same machines can be quickly re-tooled for changes in motor sizes on yearly models. Similar Bodine machines (case histories on request) process the motor pole pieces, commutators, gear housings and end plates . . . Bodine speed and low-cost efficiency ALL the way.

PRODUCTION on this machine, with its specially designed electronic programming motor on the main drive to cut every second of idle time, is 675 pieces per 50-minute hour.

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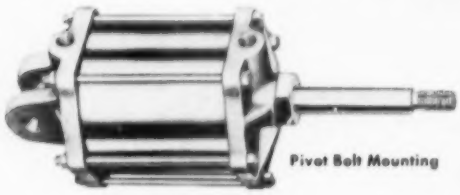
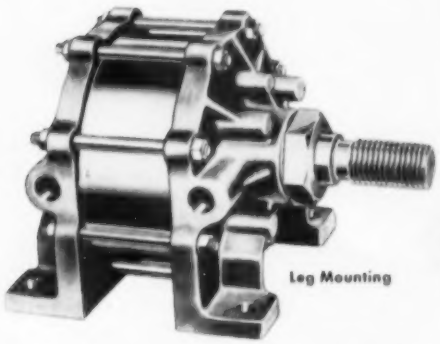


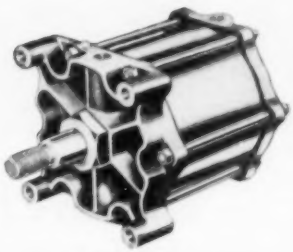
Pivot Bolt Mounting



Leg Mounting

Base Mounting

Small Clamping Cylinders



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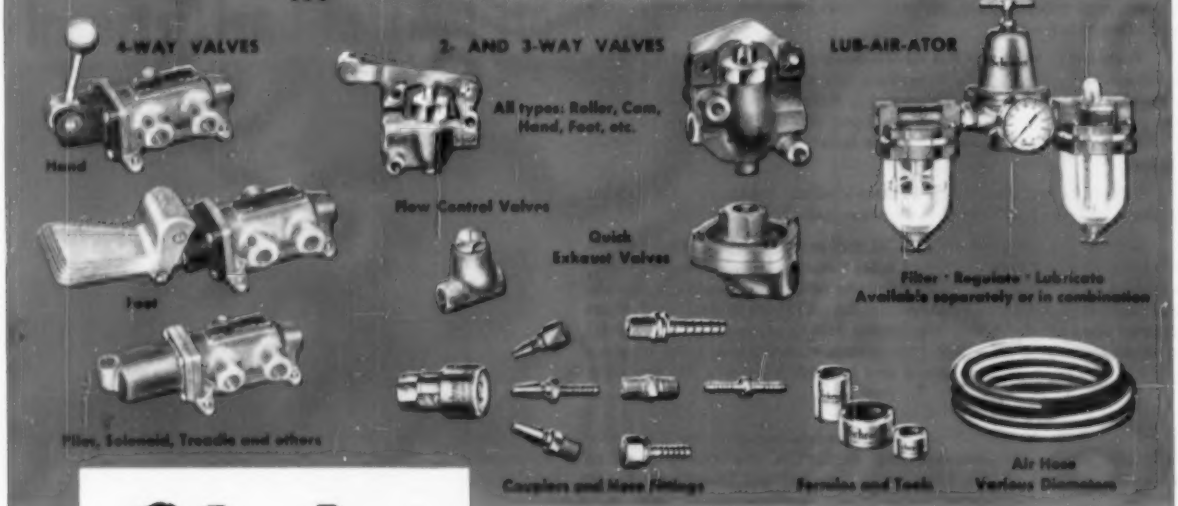

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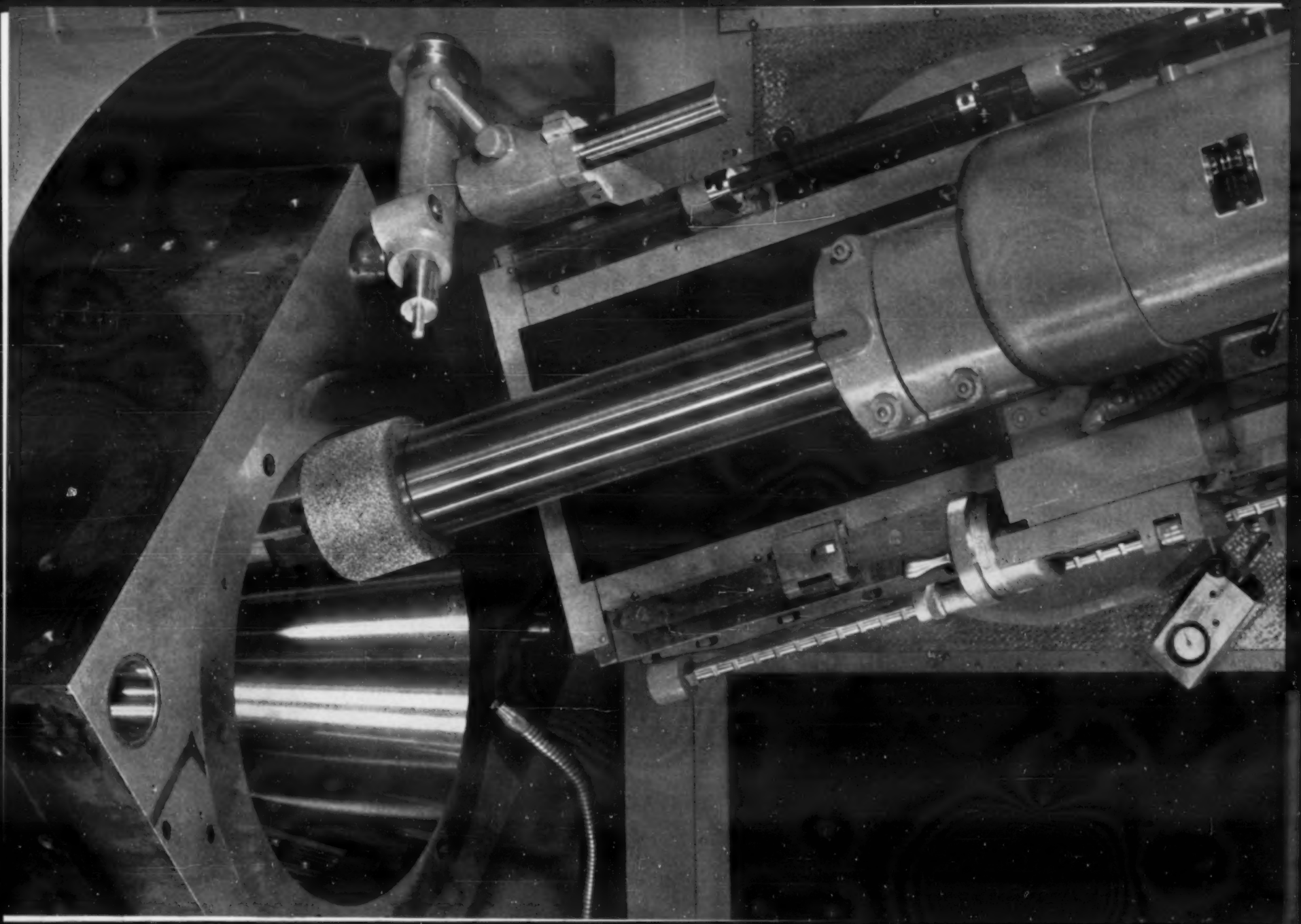

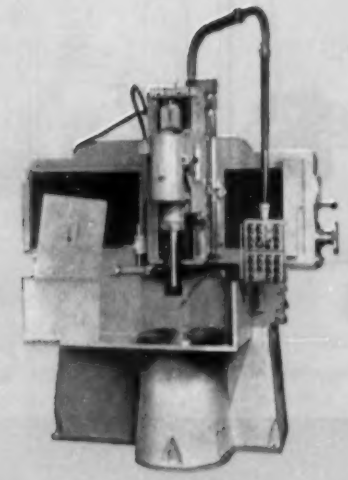

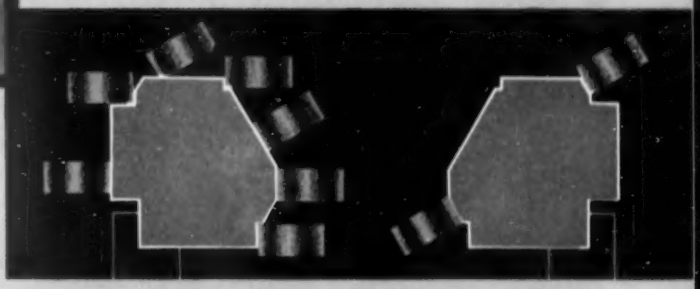

one setup: nine jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

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Lathes: Engine and tool room, contouring and reproducing—swings 14″ to 32″.

The Springfield Machine Tool Company
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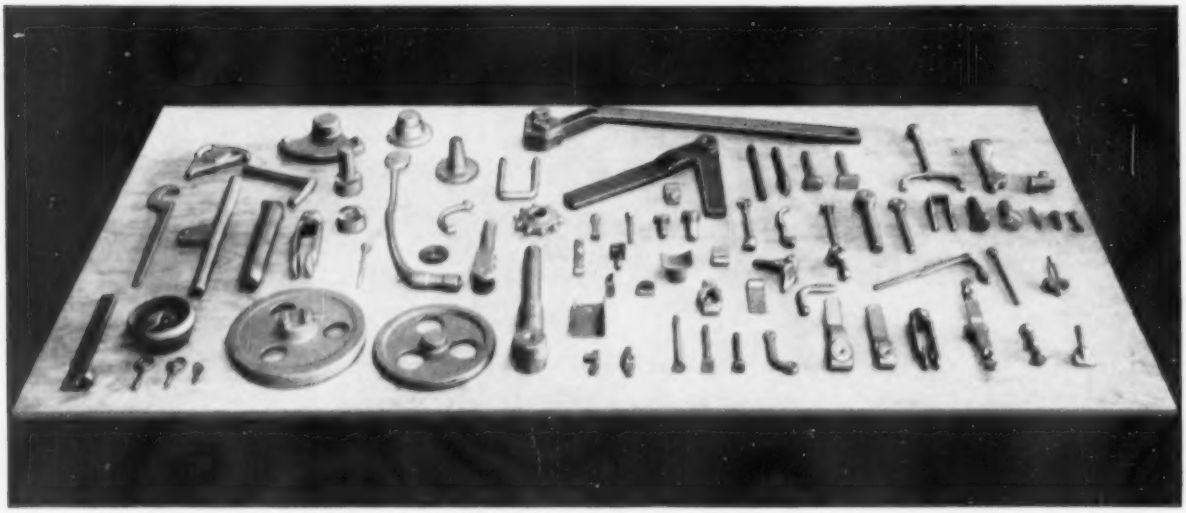

• When progressive production people at General Railway Signal Company installed a 200 kw, 3000 cycle TOCCO machine, they were able to eliminate 7 slot-type oil-fired furnaces and produce better forgings than ever before—at substantially lower costs.

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Better Working Conditions—TOCCO makes the forge shop a better place to work by doing away with noise, dust, dirt, smoke and radiant heat and gases produced by old fashioned furnaces.

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The Tool Engineer

Who Expects What?

This year, thousands of young men will graduate from colleges and universities and go into engineering. Industry and the young engineer should each know what the other expects. We, as ASTE members, should aid both industry and the beginners to understand each other.

Today's student expects to have a job where he can apply the tools he obtained through education. It is important to him that he have a chance for advancement. He is eager to exploit new fields and expects his job to be a path to new knowledge. So that these men can develop their latent abilities, their expectations should be considered and weighed carefully.

On the other hand, industry expects the graduate engineer to have a sound educational background in engineering. Specialization is not expected because the graduate with a good foundation can be trained to be of most value to his company. Industry wants the engineer to be able to accept responsibility beyond that required by the immediate job. Engineering training leads to objective reasoning and industry expects the graduate to think for himself.

Since engineers are assuming a more active part in civic affairs, industry expects the graduate to be able to handle himself well in public. He should have some grasp of literature, current events, economics, government and history, as well as his foundation in technical matters. In addition to knowing of these things, he should be able to express himself clearly.

Most graduates have the potential to satisfy industry's expectations; industry certainly has the potential to satisfy the graduate. With ASTE helping to guide both industry and new engineers, industry will benefit from new ideas and methods, and young engineers will benefit by promotion and recognition.

H E Collins

PRESIDENT

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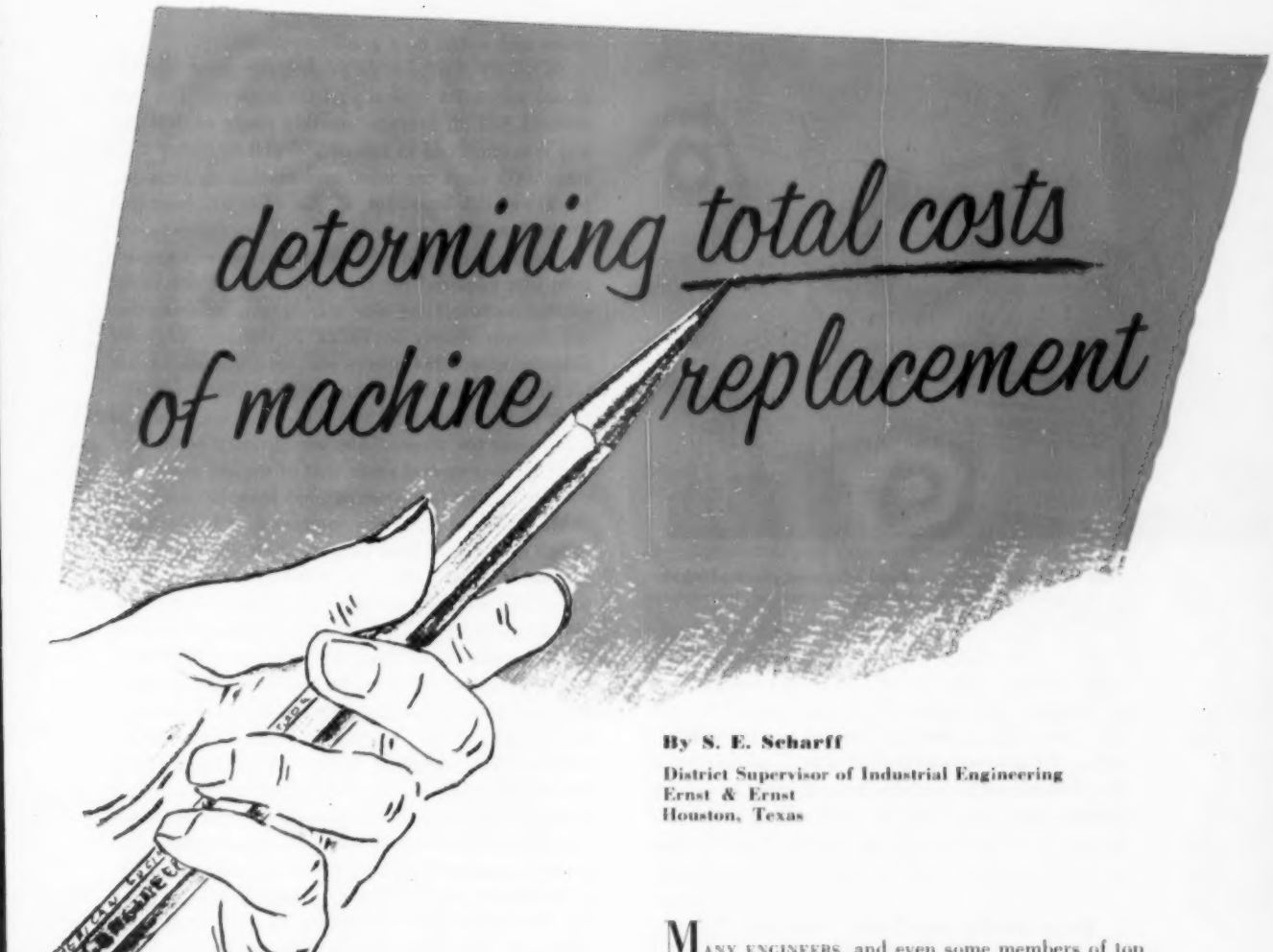
determining total costs of machine replacement



By S. E. Scharff

District Supervisor of Industrial Engineering
Ernst & Ernst
Houston, Texas

What is the real cost of a new machine or piece of equipment? How soon will it pay for itself? How will the purchase affect the over-all financial position of a company? The author gives a case history which shows how these questions can be answered.

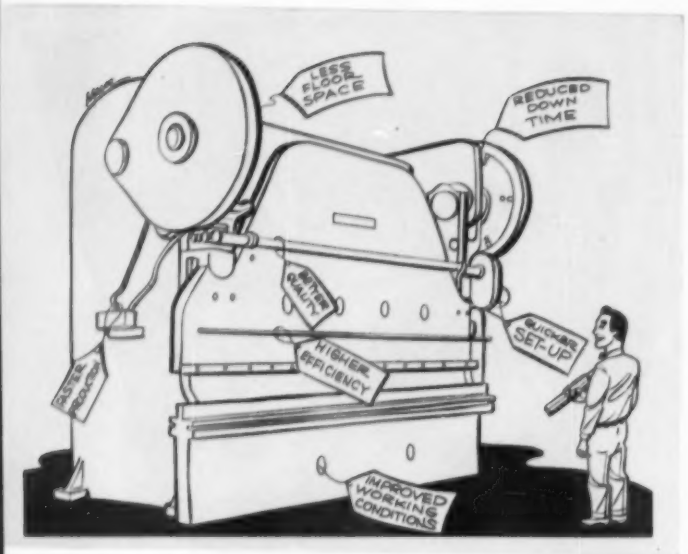
MANY ENGINEERS, and even some members of top management, habitually justify the purchase of new machine tools or process equipment on the basis of greater productivity alone. When considering a new machine, their reasoning is: "Because of its greater productivity this machine will pay for itself in four years. Since it has a normal useful life of ten years, it is a good investment."

Pay-Out Period: The calculations made to determine the length of the pay-out period may be made on the back of an envelope or they may be

Table 1—Preliminary Calculation of Pay-out Period of a New Machine

Cost of new machine (installed)	$78,000
Trade-in on old machines	5,000
Net Cost of new machine	$73,000
Present labor: 3 men (3 machines), 2 shifts = 6 man-shifts	
New machine labor: 1 man (1 machine), 2 shifts = 2 man-shifts	
Difference = 4 man-shifts	
4 man-shifts @40 hours per week = 160 hrs/wk.	
160 hrs x 52 wks. x $2.25/hr = $18,720 labor savings per year	
$73,000 ÷ $18,720 = 3.9 (4 years) pay-out period	

Abstracted from Paper No. 4, "Some Economic Aspects of Machine Tool Selection," presented at the 25th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society headquarters.



Tool engineer views purchase of a new piece of equipment primarily from the standpoint of immediate benefits in his plant.

quite elaborate. In one typical case, the machine in question was a general-purpose automatic machine, used for the manufacture of several different parts. Rough calculations, TABLE 1, showed that the machine would replace three old machines on a shift-for-shift basis. On the basis of improved productivity, the machine would pay for itself in four years and would be a good investment.

To verify this pay-out period, the plant tool engineer selected a typical part for analysis. The part selected had an average monthly usage of 100 and was manufactured in lots of 200 pieces. Setup time was 0.005 hour per piece and machining time per piece was 0.4 hour, for a total of 0.405 hour per piece, TABLE 2.

The setup time for the new machine was greater than that required for the three existing machines, so the economic lot size was larger. Making the calculations shown in TABLE 3, the tool engineer determined that 600 pieces was the optimum lot size for the new machine. Setup time per piece was 0.01 hour and running time was 0.11 hour, for a total of 0.120 hour per piece. Thus productivity of the new machine was several times that of the old machines, confirming the four-year pay-out period.

Management, however, suggested that the company's cost accountant be consulted. Together, the tool engineer and the accountant investigated additional factors which affected the length of the pay-out period. It was immediately apparent that the larger lot size would result in higher inventory costs.

The accountant knew that it cost the company about 15 percent of average inventory value to carry that inventory for one year, due to interest on investment in inventory, insurance, occupancy and similar costs. To arrive at the effect of this expense on the length of the pay-out period, it was first necessary to calculate the factory cost per piece. The factory overhead was 105 percent, exclusive of depreciation on machine tools. Material cost per piece for the typical part was $2.35. Factory costs were $4.22 per part for production on the old machines and $2.90 per part for output on the new machine, TABLE 4. Average inventory levels were estimated at 125 and 350 parts, representing investments of $528 and $1015, respectively. Applying the 15 percent carrying cost figure to these amounts, relative yearly inventory costs amounted to $79 for typical parts made on the old machines and $152 for parts made on the new machine. On this basis, the total added yearly inventory costs attributable to all parts made on the new machine were $2350.

The accountant then called attention to the fact that interest charges must also be considered in evaluating the economics of machine replacement. The company was operating partially on borrowed capital and was paying 5½ percent interest. Based on past debt repayment records, money borrowed to purchase the new machine would be repaid in seven years. Interest payments would average $2000 a year for seven years.

Indirect labor costs were the next item investigated. The company had several other automatic machines. A review of indirect labor costs for these machines disclosed that they required increased toolroom and maintenance time. It was estimated that

Table 2—Present Labor Cost per Piece for Typical Part

Average monthly usage	— 100 pieces	
Average lot size	— 200 pieces	
Setup time per lot	— 1 hour	
Running time	— 0.4 hours per piece	
Man hours per lot:		
Setup		1 hour
Running, 200 x 0.4 =		80
	Total	81 hours

81 / 200 = 0.405 hours per piece

Labor cost = 0.405 hour @ $2.25 per hour = $0.91 per piece

Table 3—Predicted Labor Cost per Piece for Typical Part

	Supply (months)				
	2	4	6	8	10
Pieces per lot (number)	200	400	600	800	1,000
Setup time per lot (hours)	6	6	6	6	6
Running time (hours) (0.11 hours/piece)	22	44	66	88	110
Total hours	28	50	72	94	116
Hours per piece	0.140	0.125	0.120	0.118	0.116
Labor cost per piece @$2.25/hr	$0.32	$0.28	$0.27	$0.27	$0.26

(Six months' supply selected as economic lot size)

Present labor cost per piece	$0.91
Predicted labor cost per piece	$0.27

Ratio of predicted to present labor cost = 0.27 ÷ 0.91 = 0.3

Table 4—Cost of Carrying Parts Inventory

	Old Machines	New Machine
Labor cost per piece of typical part	$ 0.91	$ 0.27
Overhead @ 105%	0.96	0.28
Material cost per piece	2.35	2.35
Total factory cost	$ 4.22	$ 2.90
Average inventory level (pieces) of typical part	125	350
Avearge inventory investment	$ 528	$ 1,015
Carrying cost per year @ 15%	$ 79	$ 152
Total labor cost on annual supply of 1200 pieces of typical part	$ 1,090	$ 325
Ratio of carrying costs to labor costs	0.073	0.468
Total annual wages for all parts on these machines	$28,080	$ 9,360
Corresponding carrying costs	$ 2,050	$ 4,400
Difference		$ 2,350

the preparation of jigs, fixtures and tooling not included in the original purchase price of the new machine, plus maintenance of the machine itself, would require one-half of one man's time on a yearly average. This time was valued at $3.00 per hour or $3150 per year. By comparison, toolroom and maintenance labor expenses on the old machines amounted to $1800 yearly. Thus an additional expensive of $1350 per year would be incurred with the new machine.

The effect of inventory, interest and indirect labor costs on length of the pay-out period is shown in TABLE 5. It will be noted that the $18,720 originally estimated as applicable to pay-out has been reduced by some $5700. The original four-year pay-out period is now 5.6 years.

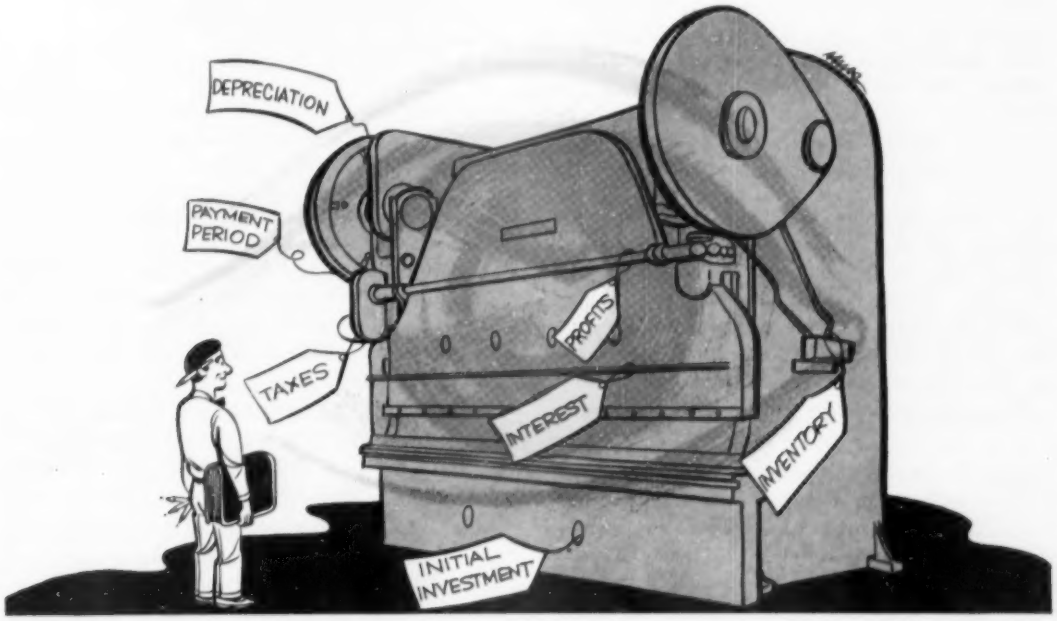
Many other factors also influence the length of the pay-out period, favorably or unfavorably. To mention a few:

1. Savings from quantity purchases of materials to conform with larger lot sizes
2. Material handling costs
3. Effect on other operations
4. Reduced or increased floor space requirements
5. Power and other utility costs
6. Quality control and inspection costs
7. Effect on overtime premiums.

Profits: The results of pay-out calculations do not, in themselves, always lead to sound decisions because of the failure to take into consideration the effect of the purchase of a machine on profits and on the financial position of a company. Certain intangible items, particularly obsolescence of equipment or product, must also be considered.

Recognizing the importance of these factors, the accountant did some additional figuring. He first computed the effect increased indebtedness would have on his company's ratio of current assets to current liabilities. This ratio had been averaging close to 2.6:1 and would be reduced to 2.2:1 with purchase of the new machine. The 2.2:1 ratio was considered to be in accord with sound practice.

Next, the accountant reviewed probable cash requirements to determine if the company would be required to borrow money within the next few years



Cost accountant looks at new piece of equipment from a different standpoint than the tool engineer—he's interested in its long-range effect on his company's profit-and-loss statement.

Final decision on equipment purchases is made by management after evaluating all pertinent cost and production figures—and taking a long look at the future.

for ordinary operating capital and, if so, what effect a loan to buy the machine would have on the borrowing ability of the company. He determined that any future borrowing would probably be in the form of short-term loans for small amounts of money and decided that the 2.2:1 operating ratio would permit such borrowing.

The accountant and the tool engineer then investigated the effect of depreciation methods on profits. The accountant explained that depreciation is a noncash expense. In a sense it is money a company pays to itself. He defined the depreciation period as the estimated useful life of a machine. It was agreed that the new machine would become obsolete at the end of ten years.

Any one of three methods of computing depreciation can be applied to new capital assets with a life of three years or more under present federal tax regulations. These are:

1. The "straight-line" method, in which the same amount of depreciation is taken during each year of life of the asset.
2. "Double-declining-balance," where a percentage equal to twice the average percent of depreciation is applied to the undepreciated balance each year. If

Table 5—Adjustment of Original Pay-Out Figures for Purchase of a New Machine

Estimated annual saving in direct labor		$18,720
Additional cost to carry inventory	$2,350	
Interest on borrowed capital	2,000	
Increased toolroom and maintenance labor	1,350	5,700
Net applicable to pay-out		$13,020

$73,000 ÷ $13,020 = 5.6 year pay-out

carried through indefinitely, this method would never fully depreciate an asset, so at some point a switch is made to the straight-line method.

3. "Sum-of-the-digits." In this method, numbers representing the years over which the asset is to be depreciated are addel together to determine the denominator of a fraction. The denominator is held constant while the numerator is the remaining life of the asset in years. The resulting fraction is applied to the depreciable amount. For example, if an asset has a ten-year life, the constant denominator is the sum of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 55. The numerator for the first year is 10; for the second year, 9 and so on. For an asset costing $75,000, depreciation for the first year would be 10/55ths of $75,000 or $13,636.

Table 6—Depreciation of a New Machine over 10-year Period

Year No.	Straight Line	Double Declining Balance*	Sum-of-The-Digits
1	$ 7,500	$15,000	$13,636
2	7,500	12,000	12,273
3	7,500	9,600	10,909
4	7,500	7,680	9,545
5	7,500	6,144	8,182
6	7,500	4,915	6,819
7	7,500	4,915	5,454
8	7,500	4,915	4,091
9	7,500	4,915	2,727
10	7,500	4,916	1,364
Total	$75,000	$75,000	$75,000

Note: Cost of new machine $78,000
Probable salvage value 3,000
Cost subject to depreciation $75,000
*Switching to straight-line method after 5th year

The schedules shown in TABLE 6 illustrate that the double-declining-balance method gives the most rapid depreciation during the early years of asset life. The sum-of-the-digits method also allows fast depreciation during the early years and allows $54,545 depreciation in the first five years, as compared to $50,424 by the double declining balance method. With the straight-line method, of course, depreciation expense is spread evenly over the life of the asset.

To return to the case study at hand, the tool engineer and the cost accountant selected the sum-of-the-digits method for computing the effect of depreciation on profits. TABLE 7 shows the net amount applicable to pay-out, the additional depreciation expense and the probable increase or decrease of profits which could be attributed to the purchase of the new machine. Over the ten years of depreciable life of the machine, the increased profits would amount to $61,200, an average of $6120 per year. This is one-third of the figure used in determining the four-year pay-out period.

It is interesting to note that the table shows a loss for the first year, using the sum-of-the-digits method of computing depreciation. Profits do not become sizable until several years have passed. If the straight-line method had been used for computing depreciation, there would have been profits of $5520 per year for each of the first seven years of machine life.

Table 7—Effect of a Machine Tool Purchase on Profits

Year No.	Net Amount Applicable to Pay-out*	Additional Depreciation Expense	Increase or (Decrease) of Profits Each year	Cumulative
1	$ 13,020	$13,636	—$616	—$616
2	13,020	12,273	747	131
3	13,020	10,909	2,111	2,242
4	13,020	9,545	3,475	5,717
5	13,020	8,182	4,838	10,555
6	13,020	6,819	6,201	16,756
7	13,020	5,454	7,566	24,322
8	15,020	4,091	10,929	35,251
9	15,020	2,727	12,293	47,544
10	15,020	1,364	13,656	61,200
Total	$136,200	$75,000	$61,200	

*See TABLE 5. This amount has been held constant for the 7-year period through which interest would run, then increased by $2000 per year, the amount of the interest.

The reason for selecting a rapid depreciation formula is that it reduces income tax payments during the early years of the depreciation period. Many companies which are operating efficiently and profitably prefer to take this reduction in the early years, since it is easier to foresee business conditions a few years ahead than it is to predict what they will be five to ten years in the future. At best, selecting a rapid depreciation formula is a risk, but it is a calculated risk.

Companies which are not operating at a profit, especially young, growing companies, usually shun rapid depreciation formulas, preferring to save depreciation expense for later years which may be more profitable. Hence, they normally select the straight-line method.

While the case history discussed is somewhat simplified, it serves to illustrate the dangers of using only direct labor costs in determining the pay-out period for new machinery and equipment. In many intsances, a company cannot survive unless the most advanced and efficient machines and equipment available are purchased and used. At the same time, a machine should not be purchased unless all of the pertinent factors which affect profits are taken into consideration.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.

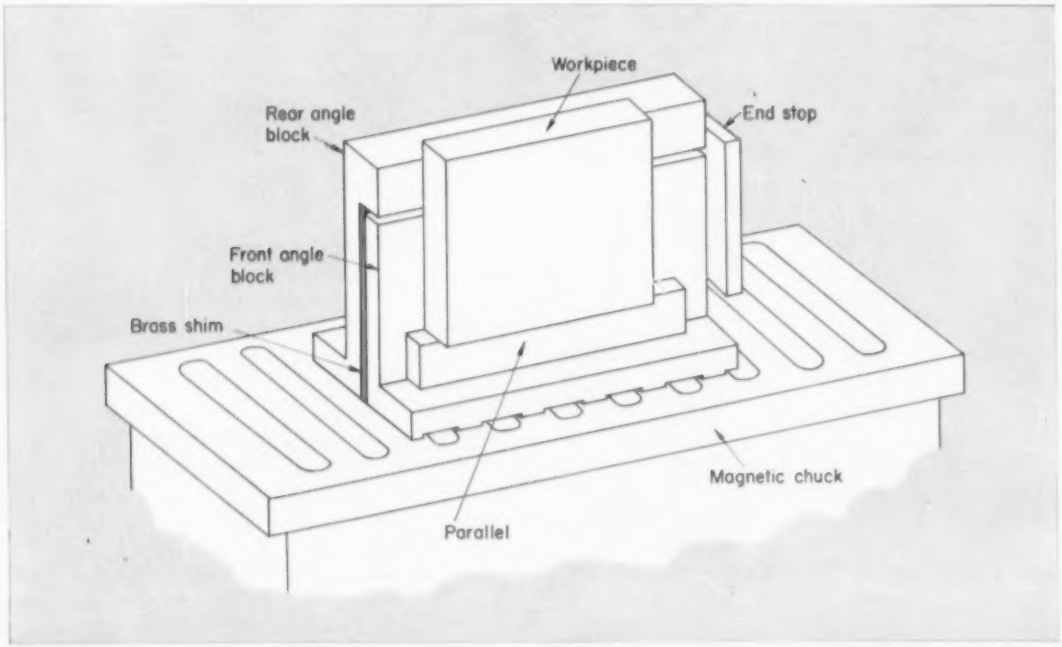
Magnetic Angle Plate

When edges of die blocks and fixture bases are squared up in a surface grinder, clamps are usually used to hold the workpiece vertically against an angle plate. A magnetic angle plate fixture, designed for use with a magnetic chuck, facilitates setting up work of this kind. The fixture consists of two angle blocks, one set into the other. A brass shim between the two blocks provides insulation against leakage of magnetic flux and the blocks are held together by brass rivets. Bottoms of the blocks are slotted so that the front block contacts the face of the magnetic chuck, and the rear block contacts only the magnetic poles.

Workpieces are mounted on the fixture as illustrated. A parallel is used to hold the workpiece so that its top edge projects above the top of the fixture. With the workpiece in place, the magnetic flux flows from the chuck through the rear angle block to the workpiece, then through the front angle and back to the chuck, thus completing the magnetic circuit.

When a workpiece must be ground square with an adjacent edge, it can be butted against an end stop. The stop is made of nonmagnetic stainless steel to prevent it from conducting magnetic flux, and can be removed from the chuck when desired. The fixture has proven to be satisfactory in shop use and saves the time required for clamping and unclamping by conventional methods.

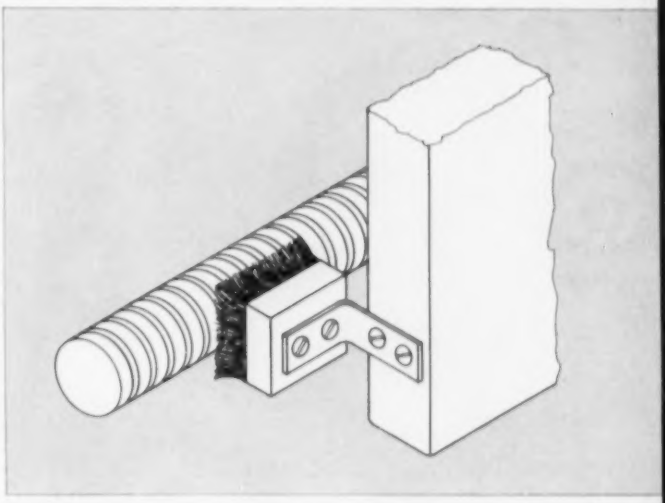
Ernest Jones
Bronx, N. Y.



Feed Screw Cleaner

Lathe feed screws are exposed to chips and dirt which can cause excessive wear on the screw and be carried to other components of the machine. A good way to keep the feed screw clean is to mount a small brush on each end of the lathe carriage, as shown in the drawing. Nylon-bristle hand brushes, widely available, can be cut in half and used for this application. They are inexpensive, and replacements can be readily obtained.

Clint McLaughlin
New York, N. Y.



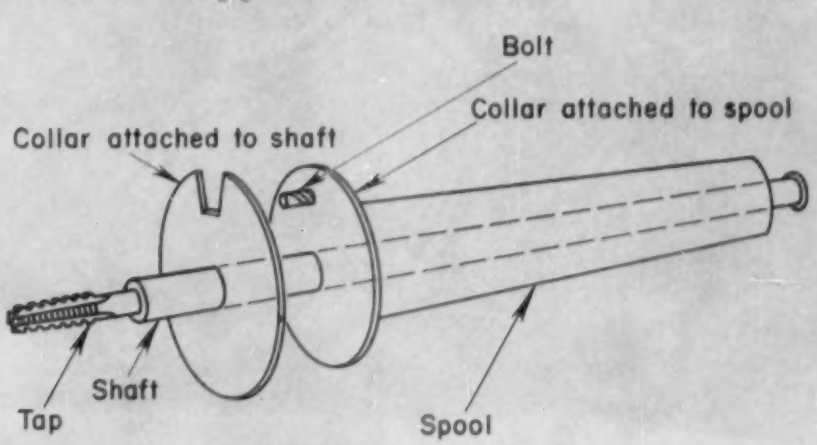
Tapping Tool

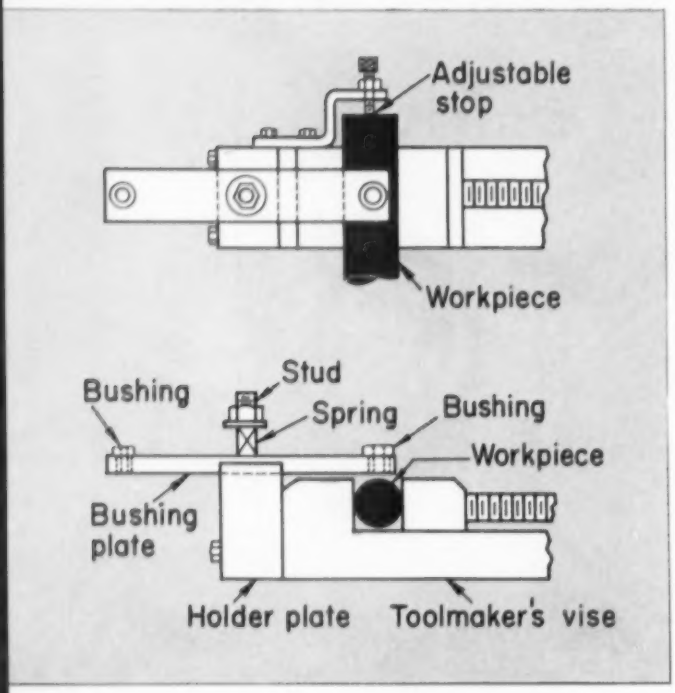
Depth of tap can be regulated automatically with a lathe tapping tool as illustrated. The tool consists of a shaft to hold the tap and a tapered spool, which fits into the tailstock of a lathe. The shaft slides freely in the spool. Two collars, one attached to the spool and the other attached to the shaft, are other components of the tool. A bolt on the collar attached to the spool fits into a slot on the collar attached to the shaft. The bolt is adjusted to give the desired depth of tap.

As the tap is fed into a revolving workpiece, the spool and shaft, linked by the bolt, revolve as a unit. When the desired depth of tap has been reached, the notched collar disengages from the bolt, allowing the tap to revolve freely with the workpiece. To remove the tap, the bolt is again fitted into the slot and the direction of rotation of the workpiece is reversed.

This tool is currently being used in the research laboratories of Allis-Chalmers Manufacturing Company to tap holes in fatigue test bars and other types of work requiring small tapped holes. With the tool holes are tapped more accurately with less tap breakage and about three times faster than with conventional tapping methods.

Victor Cain
Milwaukee, Wisconsin





Drilling-Reaming Jig

Drilling and reaming operations on round shafts can be expedited by the use of a jig which was improvised but proved so satisfactory it is now in regular service. Basic element is an ordinary toolmaker's vise, which is used to hold the workpiece in position.

To complete the jig, a holder plate is attached to the stationary end of the vise. Drilling and reaming bushings are inserted into each end of a bushing plate. The bushing plate turns on a stud projecting from the holder plate. A slot milled in the holder plate locks the bushing plate in proper alignment.

A light spring holds the bushing plate down, allowing it to be lifted and swung around when changing from drilling to reaming operations or vice versa. An adjustable screw attached to a bracket mounted on the side of the vise serves as an adjustable stop for locating the end of the workpiece.

Frederico Strasser
Santiago, Chile

Size Identification of Drills

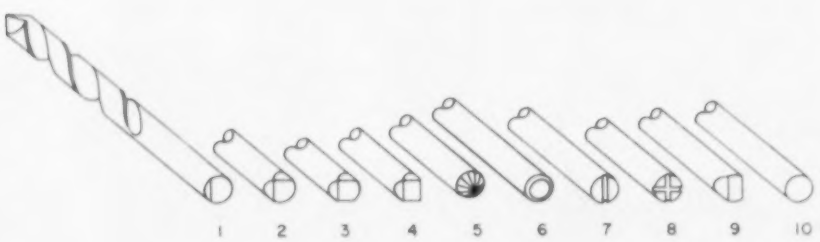
It was observed in a study of toolroom methods, that toolmakers play safe and "mike" drills before using them. They do not depend on identification numbers on the drill stand, since a drill may be in the wrong hole. Identification numbers marked on drills by the manufacturers soon wear off.

To save time spent in measuring drills, a drill marking system was worked out. All drills are now coded at the time they are received from the manufacturer as shown in the accompanying illustration. This is accomplished by grinding an identification on the end of the drill shank.

The code adopted is applicable to all drills of the number series. The same identification is used for each number ending in the same digit. For example, the "6" identification is used for drill numbers 6, 16, 26, 46 and 56. The size difference between these drills is sufficient for the toolmaker to distinguish between them by eye.

When the coding system was introduced, each toolmaker was provided with a drawing showing the identification code. Within a few days all personnel in the shop were familiar enough with the code so they could pick out the correct drill without referring to the drawing.

Henry Koslow
Bronx, New York



Gadgets

Collet Heat-Treating

Machining special collets present no unusual problems in a well-equipped toolroom. Often, however, accurately machined collets are warped or distorted during heat-treatment.

One way of preventing collets from compressing during heat-treatment is to leave a thin web of metal between the slots. This web can be readily ground out after the collet is heat-treated. Another method is to press a tapered mandrel into the work-holding opening of the collet prior to heat treatment. The mandrel will prevent the collet from closing when it is heated.

Uniform heating is important to prevent distortion and when a collet is quenched it should be dipped into the quenching medium so that all prongs are cooled simultaneously. Ends of the collet should then be tempered to reduce brittleness which might cause breakage in service. The prongs can then be ground and polished as required.

F. L. Rush
Columbus, Ohio

Forming Die

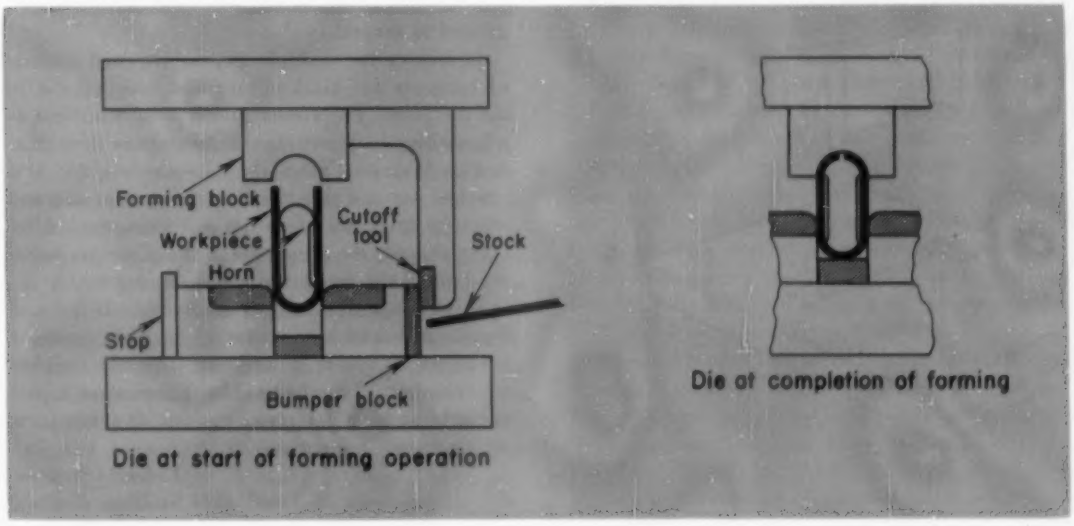
In order to utilize press equipment to the maximum, it is advantageous to incorporate as many operations as possible on one die. At the same time, complex dies, utilizing cams or other devices to perform multiple operations, are often subject to excessive maintenance. The die illustrated is simple in design, yet it replaced three separate dies previously used to form the same part. The entire die is constructed of unhardened cold-rolled steel, with the exception of hardened inserts, shown as shaded areas on the drawing. These inserts are covered with hard-bronze wear plates (not shown) and all areas are kept well-lubricated.

In operation, strip stock is fed through the die to a stop. As the ram descends, the stock is first sheared to length. There is only one-sixteenth inch vertical distance between the cutoff tool and the horn, so the horn comes into contact with the blank immediately after the blank is cut, thus preventing the blank from moving out of location. The horn forces the blank into the die opening, bending it into a U-shape as shown. When the part reaches the bottom of the opening, it strikes a bumper block. The downward motion of the horn, which is spring-mounted, stops at this point.

As the ram continues its descent, the closing block contacts the two free ends of the workpiece, completing the forming operations. Due to springback of the steel, the finished part is readily removed from the horn, either by hand or mechanical kick-outs.

The die has produced thousands of satisfactory parts with minimum down time. There has also been a substantial reduction in scrap as compared to the former three-die method of manufacture.

Buckley Sullivan
Cleveland, Ohio



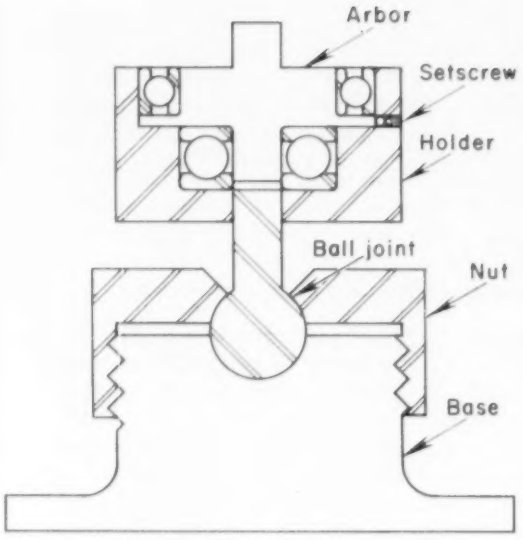
Gadgets

Cutter Grinding Fixture

Grinding time savings of about 30 minutes per milling cutter have been made possible by the fixture illustrated, which is designed to permit angular grinding of all teeth on a cutter with only one setting. The cutter is mounted on a rotating arbor, which is in turn mounted on a holder. A ball-joint arrangement allows the holder to be tilted at any desired angle up to 20 degrees. The holder is retained on a heavy base by means of a large locknut.

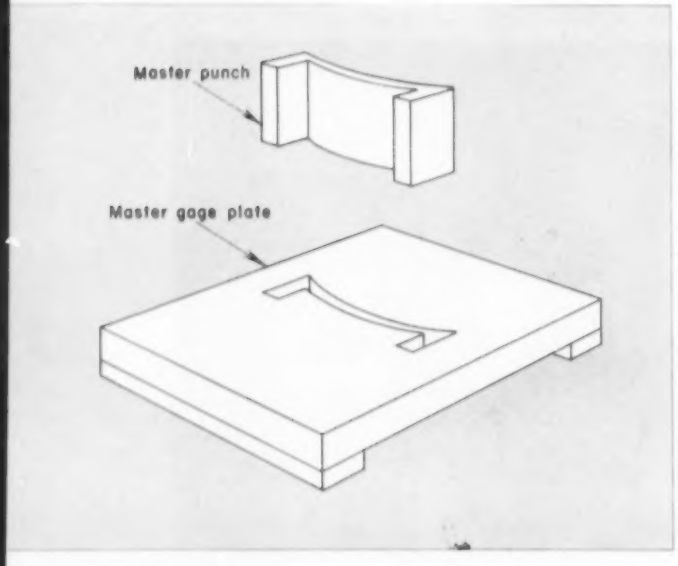
With a cutter mounted on the arbor, the holder is tilted to the required angle and locked in place with the nut. Each cutter tooth will then be at the correct angle when it is swung into position for grinding. A setscrew is used to lock the arbor in place for grinding.

John Zore
Milwaukee, Wis.



Multiple Die Construction

In die construction, extra time spent in planning and preparation before actually building often pays off in terms of increased accuracy or shortened construction time. This is particularly true in the case of multiple blanking dies, designed to produce two or more identical parts with each press stroke.



An effective method of constructing such a die is to first make a master punch, which is identical to the punches to be used in the die, and a gage plate with an opening to fit the master punch. The punch and gage plate are both steel, hardened and ground to shape.

In making the multiple die, the required number of openings for blanking are first roughed out in the die plate. The master punch is then utilized as a broaching tool to bring the openings to their final size and shape. Similarly, all punches are first roughed out and then are brought to final size and shape by using the gage plate as a sizing tool. After being shaped, the punches and die plate are hardened and finish-ground in the usual manner.

This method of making a multiple die is fast and has the added advantage that all die plate openings are identical, as are all punches. Thus the punches are completely interchangeable. The method is particularly suitable for making small dies for parts with intricate contours.

Federico Strasser
Santiago de Chile

preparing for a *tool engineering* career

By Frederick Preator*

Head, Tool Engineering Dept.
Utah State Agricultural College
Logan, Utah

Success in tool engineering, as in any profession, depends on adequate preparation. Requirements and opportunities are outlined in the following article, emphasizing the essential background and abilities needed.

THIS IS AN AGE of power, precision and production. Many persons now living have witnessed the progress from horsepower through steam, electrical combustion and into the age of atomic power. Precision is one key to this progress. It is now possible to detect sounds which before were inaudible; to see organisms which defied previous attempts at observation; and to measure in units of millionths.

In production the United States is the world's greatest producer of wealth in agriculture and in manufactured goods. Also, the U.S.A. is the world's greatest consumer of goods and services. At the same time, it remains the arsenal of world democracy.

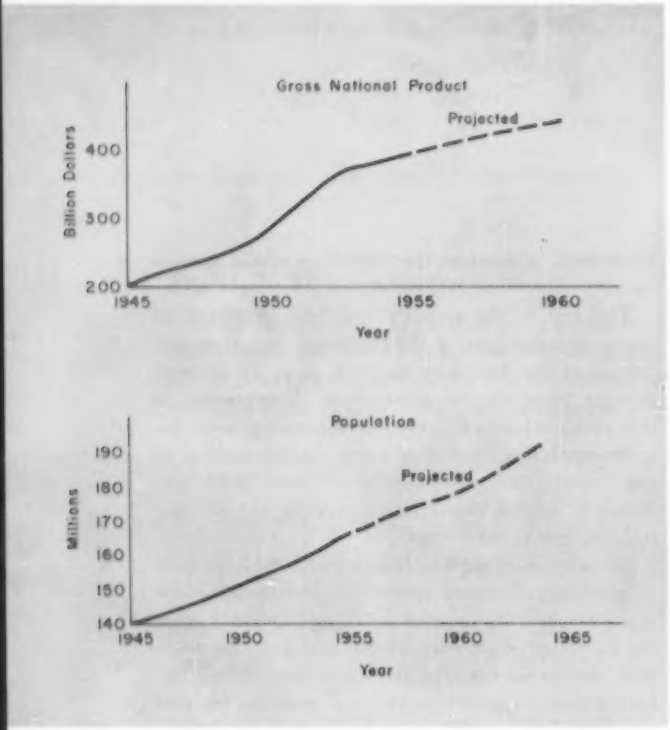
The key to the security and high standard of living enjoyed here is the ingenuity and resourcefulness of the American engineer in applying engineering principles to production. Everywhere in this technical society, there is a growing need for more emphasis on and a better understanding of mathematics and the physical sciences. Such emphasis is needed to prepare people to live successfully in this dynamic age.

The success of modern industry and the high level of efficiency obtained in the production of goods and services have resulted in a large measure from the successful teamwork of the scientist, the engineer, the technician and the craftsman. Numerous surveys have reported varying ratios of the number of technicians needed on a successful production team. One survey reported it to be as high as 7:1, but the ratio will vary in different industries and in different types of work.

One significant fact is evident; namely, that new technical occupations are continually emerging in old and new industries alike. New methods, new skills, a new approach to training and new curricula are required. These new occupations in an industrial age which is moving toward automatic

*Senior member ASTE Salt Lake City chapter.

Education is a never-ending need in industry to keep pace with developments. These engineers at the tool engineering institute, held annually at the University of Wisconsin, are discussing new and improved ways to process a part.



Trends in gross national product and population growth, as forecast by these charts, clearly show the necessity of increasing productivity of industry.

production, will require technicians with special training and special skills.

All available statistics on present enrollments in engineering and technical training programs indicate that a critical man-power shortage exists on the production team and will continue in the foreseeable future. The challenge presents itself for those with the basic abilities to prepare for profitable careers in the great American production system.

To grasp an idea of the scope of the challenge, one should consider population trends. It has been predicted that by 1975, at the present pattern of population growth, the U. S. will increase by 45 million people. From the statistical abstract of the United States can be found data which indicate significant trends in both gross national products and in population.

As shown in the accompanying chart, gross national products, representing the total national output of goods and services at market prices, have climbed steadily in recent years.

This must be considered in relation to the population curve, as shown. That curve also is sharply upward. Perhaps the most important but least publicized fact in the past year was that over 4,200,000 children were born. The significance of this population increase in recent years is the fact that it reduces the percentage of productive workers in our society. Also noticeable is the trend to a lower retirement age. Such factors place increasing demands on the country's productivity without proportionately increasing the labor supply. It is necessary to increase the productivity in order to

maintain the present standard of living. For the future it will be necessary to be prepared with better materials, improved methods and machines and increasing productivity. This is the challenge of the tool engineer. It is apparent from the facts cited that the future holds untold opportunities for him.

To cite some examples, it has been said of the chemical industry that half of its present manufactured products were unknown twenty years ago. When electricity was demonstrated by an English scientist in the late nineteenth century, he was asked what useful purpose it might serve. Perhaps cynically, but prophetically, he referred to it as a possible future source of taxable revenue. Obviously this discovery has more than fulfilled his expectation. It is now predicted that the electrical industry will double in the size and value of its manufactured products in the next ten years.

Thus, out of the explorations of science come new theories, new materials, new methods, new industries and new products. A question for everyone is: what will the future mean in terms of goods, materials, housing, transportation, natural resources and available man power? The answers depend on an adequate supply of people with the education, technical training and skill to qualify for the scientific and engineering demands of an expanding technological age.

The increasing technical complexity of society, due to this introduction of new materials, methods, products and radically new approaches to production problems, has created a pressing demand for tool engineers trained in the technology of industrial production. Mechanical skills and aptitudes and a curiosity about things mechanical are an asset in this field, but they are not enough.

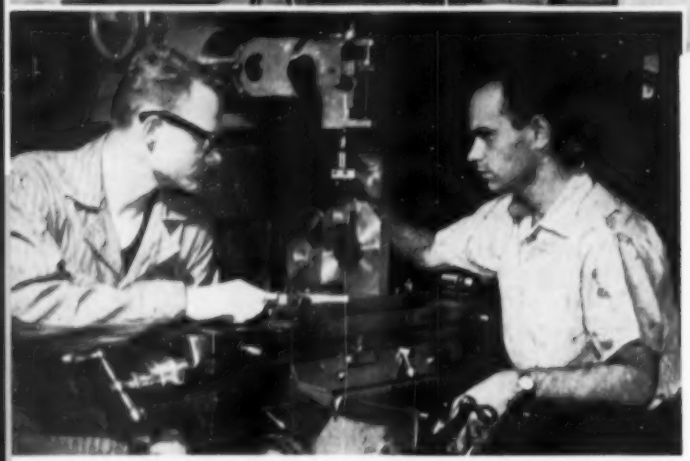
Today the avenue of approach to a successful engineering career in manufacturing is through an engineering education. The reasons for this are evident when one considers the duties and responsibilities of tool engineers. These men usually work together in developing their plans. There must always exist a close cooperation between industrial design, materials processing, safety and production. The success of any manufactured product and the efficiency of production rest largely with the tool engineer.

He is continually analyzing, organizing and planning operations of the plant, the tooling and the people. Essentially he is an industrial executive, because the greatest industrial expenditures are in the manufacturing and processing industries.

The tool engineer must visualize in correct perspective the whole of a production problem. Planning necessitates technical reporting and recommendations for the means of production. As an executive he is required to hire personnel, make cost analyses, time studies, plan operational sequences and production procedures. Often he is responsible for purchasing and for the investment of large sums of money in tooling, machinery, production processes and plant facilities. The tool engineer is never without a challenging problem. In the country's industrial society the opportunities for solving problems by the engineer in this field are virtually endless.

Those considering a career in the field would do well to give early consideration to the requirements. The core of courses which are basic in the preparation of all students in engineering consists of engineering drawing, mathematics, physics, chemistry and English. They may represent as much as one-half of an undergraduate engineering program. The basic courses are a must for an engineering career. Added to that core of courses are special courses in materials, production planning, plant layout, time study, quality control, cost esti-

Tool engineering technicians undertake many interesting assignments and experiments with special machines and equipment at the process development group, GM Technical Center.



Engineering students (above) aiming for the manufacturing field learn machine tool fundamentals firsthand in the lab at Utah State Agricultural College.

Greater productivity (left) means increasing emphasis on research and development work. Advanced engineering students at Purdue set up a machinability experiment with their instructor.

mating and others.

A serious problem today is the lack of preparation of many high school students in mathematics and science. Parents and guidance counselors, as well as engineers in the profession, would do well to advise, wherever possible, of those courses which are a necessary part of preparation for an engineering career.

In addition to the opportunities in the engineering field itself, there are also many possibilities for entering the field as a technician. In fact, the American Society of Tool Engineers recognizes the essential nature of the program of the technical institute and the junior college in engineering education. The technical institute with its intensive program of specialized technical education offers tool engineering students an excellent opportunity to train as engineering aids.

There is great need for such trained technical assistants in industry. That need is revealed in reports released from time to time, which survey the type of work which engages the engineer, the technician and the craftsman.

The curriculum of the institute is primarily technical in nature and usually is an accelerated program requiring graduation from high school. A typical curriculum would include: technical writing, drafting, mathematics, electricity, mechanics, manufacturing processes, machine tool laboratory, inspection, tool design, tool planning and similar related courses. Wherever possible, the cooperative type of in-plant training program should supplement this type of education.

The technical institute, as its name implies, has as its major objective training of qualified individuals for technical employment on the industrial production team. In each case ultimate success in this field depends on the individual's technical abilities, aims and ambitions. The field is expanding so rapidly that the horizons appear unlimited for tool engineers.

Since the tool engineer is the man with production know-how, however, he is judged on results. He must carry his work through to the end. His plans must work. Excuses will not do. The inventor may tinker, test and experiment, but the tool engineer must produce results. Since his activities are the heart of the productive system, many other people's jobs depend upon him. That is why his is such a large and growing responsibility. To meet his responsibilities and prepare for his opportunities the tool engineer of the future will need to take advantage of the best technical training that is afforded him.

plastic draw dies their development and use

Fig. 1. Cold-rolled steel panel drawn on an epoxy-resin die with a laminate face.

By Thomas Mitchell
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Cooperation between a materials supplier and a diemaker has led to the development of stronger plastic dies with improved abrasion resistance. In this article the authors discuss some of the results of this experimentation.

PLASTIC DEVELOPMENT dies have found many important applications in industry, particularly where frequent model changes are a problem. Such dies can be fabricated in a few days, as contrasted with the many weeks required for construction of comparable metal dies. They cost much less than metal development dies and they can be altered daily, if necessary, to incorporate design changes. When a satisfactory design has been developed, the plastic die can be used as a duplicator model to produce a metal die for long-run production.

Improved plastics and improved die designs have made it possible to perform operations such as deep draws, *Fig.* 1, which were once considered beyond the capabilities of plastic tooling. A plastic die, for instance, has been used to draw cold-rolled steel sheet, 0.090 inch thick, into a four-inch-deep spherical cup shape in one operation.

Plastic dies are also being used for short production runs. One die, originally intended for development work, was subsequently used to produce a total of 2500 calculator housing stampings from 0.055-inch-thick cold-rolled steel. For production runs, wear points of plastic dies are usually reinforced with metal inserts; for development work, however, and in other cases where a small number of parts are run, the strength and abrasion resistance of plastic dies is adequate without inserts.

Most successful plastic dies are made and serviced by men who are able to apply a high degree of general tooling know-how and metal-forming experience to plastic tooling problems. Knowledge of the properties and capabilities of plastic materials is also essential.

Phenolics were the first plastic materials used extensively for die construction. These materials are still used where their strength and wear resist-

ance are adequate. Many surprisingly long production runs have been made with phenolic tooling. Phenolic tools with metal inserts, *Fig.* 2, have successfully produced as many as 100,000 automotive intake duct panels.

While dies made from phenolic materials give good results in many cases, phenolic dies have serious limitations. The abrasion resistance of these materials is reasonably adequate but they are deficient in impact strength for many applications. Their compressive strength of 10,000 psi may prove inadequate and deflection under load is relatively high, causing stampings to wrinkle during forming, *Fig.* 3. This wrinkling often causes erosion on the die face.

Dies made from glass-reinforced polyester resins are a better choice for many applications, since compressive strengths greater than 20,000 psi and shear strengths close to 7,000 psi can be obtained. Using these materials, it is possible to form light-gage metal parts on a short-run basis and to form limited quantities of heavier-gage parts. Wear resistance of polyester resins can be improved by incorporating hard fillers such as iron powders or granules. Volumetric shrinkage is high, so polyester resins are usually pressure-cast.

Epoxy-resin plastics have low-shrinkage characteristics and other qualities which make them superior as die materials, particularly for large dies. To exploit these advantages, a cooperative development program was undertaken by The Marblette Corp. and Glennie Industries. The Marblette Corp. provided a number of different epoxy resins which were put to use and evaluated by Glennie Industries. Several of these resins have proved to be outstanding for use in draw dies and other tools.

An inexpensive epoxy core resin which can be cast in large sizes with negligible shrinkage was developed. Compressive strength of this material is 15,000 psi, which is adequate for most uses. For higher strength, glass roving is added.

Because the core material has poor wear-resistance, it is necessary to face the dies with another resin. This material, a modification of a material developed to withstand sand abrasion in foundry applications, has excellent abrasion-resistance and good impact properties, plus the ability to hold an edge or sharp radii under moderate loads.

In an effort to improve the durability of sharp radii under load, tests were made with various laminating materials, and a new laminating resin was developed. This material, used with glass cloth, is applied over a heavy-consistency abrasion- resistant gel coat. One tool on which the laminating resin was used has produced parts with sharp radii, even after a production run of 250 pieces. The workpiece material was 0.033-inch-thick cold-rolled steel.

Draw rings of cast or laminated plastics give satisfactory results for short runs. For somewhat longer production runs, use of boiler-plate rings or some other type of metal insert should be considered.

The benefits resulting from the use of plastic dies are being realized by an increasingly large number of manufacturers. With the improved materials now available, even greater benefits will be obtained.

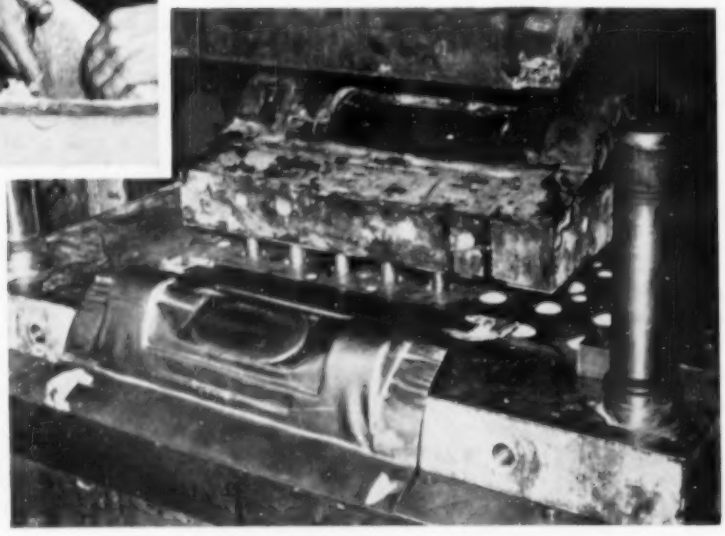

Fig. 2. Fabricating a developmental die for an automotive duct. After application of laminate to pattern, the mold is filled with a reinforced epoxy-resin.

Fig. 3. (right) Wrinkled part produced during die development. Plastic die can be quickly modified to correct this condition.

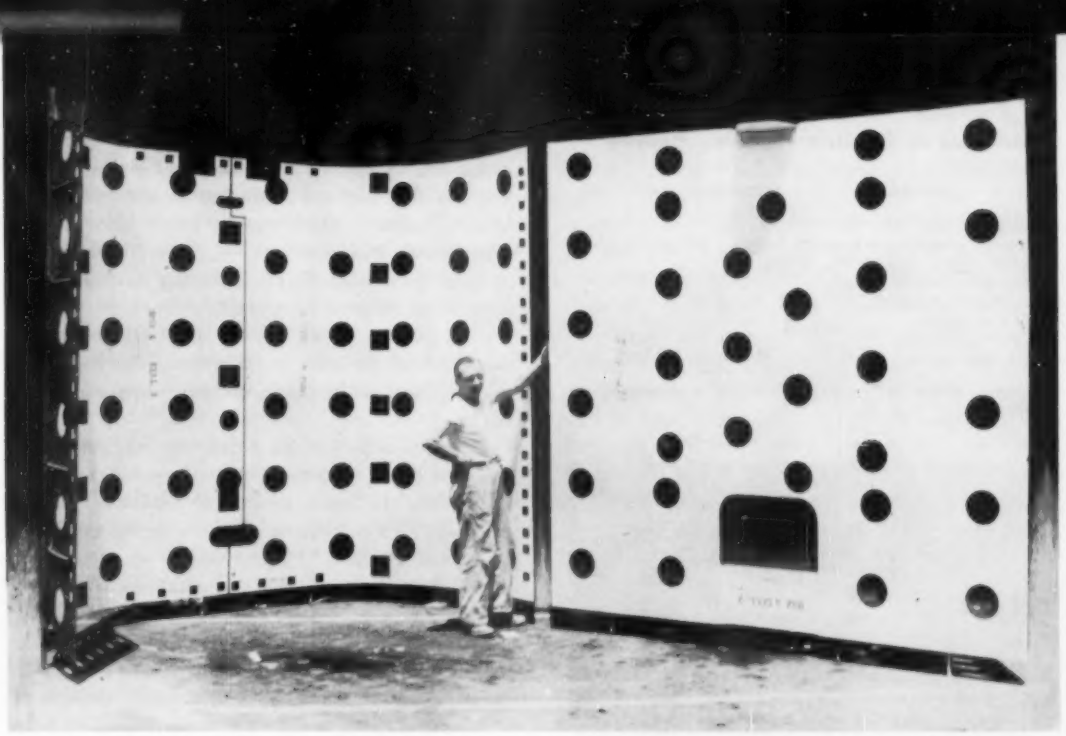

Fig. 1. Fuel cell form checking fixture built by W. B. Whittington Co. for Goodyear Aircraft.

controlling physical properties *of plastic tooling materials*

By John Delmonte
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Toolmakers can exercise many controls over the physical properties of plastics used as tooling materials. These controls are discussed by the author, who has long experience with plastic tools.

Abstracted from Paper 36, "Control of Physical Properties of Cast and Laminated Plastics," presented at the 25th ASTE Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

PLASTIC TOOLING materials include phenolics, polyesters, polyvinyls and epoxies. Since these materials have different physical properties, a toolmaker can select a material which has the best properties for a specific tooling application. Among the epoxy resins, for instance, some materials have a low modulus of elasticity, making them suitable for plastic forming dies, where resiliency is an asset. Other epoxy resins have high moduli of elasticity and are best suited for inspection fixtures, *Fig.* 1, and similar applications where stiffness is mandatory. The range of elasticity available among epoxy compositions is indicated in the accompanying table.

Curing Variables: There are many variables which affect the final physical properties of the plastics used in toolmaking. These variables must be carefully controlled for optimum results. The flexural strength of laminated epoxy resins, for example, is affected by temperature during curing

Modulus of Elasticity—Epoxy Plastics

Material	Modulus* (psi × 10^6)
Laminated Epoxies (made with No. 181 glass cloth, using vacuum pressure)	2.5 — 3.5
Laminated Epoxies (made with tooling fabrics, using contact pressure)	1.5 — 2.0
Mineral-Filled Cast Epoxies	0.7 — 0.8
Unfilled Cast Epoxies	0.4 — 0.5
Toughened Cast Epoxies	0.1 — 0.25
Resilient Cast Epoxies	— — 0.05

*Measured in flexure for laminated epoxies and in compression for cast epoxies.

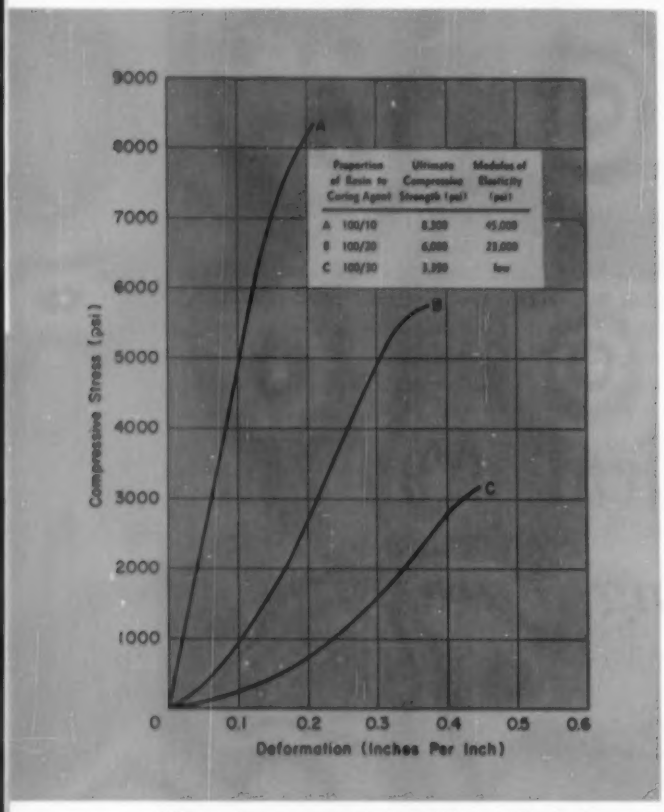

Fig. 2. An epoxy resin has different physical properties when larger amounts of curing agent are added.

and length of cure time. Best results can be obtained when curing temperatures are controlled. With equal curing times of reasonable length, high curing temperatures will give higher flexural strength than lower temperatures.

At any curing temperature, there is a relationship between length of curing time and flexural strength. Many curing agents are sensitive to moisture and when they are used under conditions of high humidity, excessively long curing times will be required to obtain adequate flexural strength. This variable can be controlled by selecting curing agents which are not moisture-sensitive.

Shrinkage is another variable which can, and must be, controlled in the manufacture of plastic tooling. There are two types of shrinkage which occur during curing: polymerization shrinkage and thermal shrinkage. Polymerization shrinkage is a known variable which can be taken into account when plastic tools are designed. Thermal shrinkage is caused by heat liberated during curing, which may raise internal temperatures in a heavy cast tool to as high as 400 F. In order to control the final size of the tool, it is necessary to limit this internal heating by using special curing agents or fillers.

Uniform oven heating during curing, sometimes referred to as "supercuring," is a good means of controlling the final size and dimensional stability of tools. This procedure, in which curing is accomplished at 120 to 150 F, minimizes the possibility of subsequent creep and shrink at room temperatures.

Warping of laminated structures during curing can result from uneven distribution of resin. Skillful handling by the toolmaker and the selection of resins which will not flow along vertical surfaces will help to eliminate warping problems.

Incomplete mixing of resins and curing agents has an adverse effect on the physical properties of plastics. Use of colored curing agents is helpful in mixing, since a striated pattern is visible until mixing is complete. With proper controls during mixing and curing, plastics have excellent dimensional stability and can even be used for inspection fixtures of large size.

It is possible to control the physical properties of epoxy compositions by varying the amount of curing agent added. Stress-strain curves for a typical epoxy casting resin, *Fig. 2*, indicate significant differences in properties when different amounts of curing agents are used.

Fillers: A common means of controlling and improving the physical properties of plastics is the use of fillers. Wear resistance of cast plastics, for instance, can be greatly improved with mineral fillers. There is an almost direct relationship between the hardness of these fillers and the wear resistance of the tooling in which they are used. Although the surface hardness of the plastic, as measured by penetration tests, primarily reflects the hardness of the resin binder, abrasion resistance or machining tests will quickly reveal the presence of hard fillers. For maximum wear resistance, tungsten carbide and aluminum oxide fillers are used. Such compositions are highly abrasive and are difficult to machine. They are especially suitable for plastic core boxes and patterns, for the edges of routing fixtures, and for similar tooling application, *Fig.* 3.

A second use of fillers is to control the density of plastics. Lead-filled plastic castings with specific gravities as high as 7.0 have been manufactured.

Iron oxide fillers also give high specific gravities. In most plastic tooling, however, emphasis is placed on light weight and low average density. Usually, the brunt of working stresses is borne by a gel coating and laminated fiberglass backup. These surfaces are backed up in turn by plastic elements which contribute stiffness without excessive weight.

Foamed phenolic or ceramic "microballoons" are often used to reduce weight of plastic tools. The average density of plastics filled with these materials is in the range of 50 to 60 lb per cu ft. Large, low-density aggregates make good fillers for epoxy resins. Average density is 45 to 55 lb per cu ft and crushing strengths are 2000-3000 psi.

When it is desirable to keep the weight of plastic tools as low as possible and the use of fillers is impractical, foamed-in-place epoxies should be considered to fill voids. These materials are economical and have densities of only 10-14 lb per cu ft. Foamed-in-place urethanes also give good results. When greater tool stiffness is required, backup materials such as paper-base honeycombs are of value. These materials can be readily bonded to a laminated skin or gel coat, giving stiffness without much increase in weight. The honeycomb structure does not lend itself to shaping or abrupt changes in contours. Tubing can also be used to stiffen plastic tools, with small weight increase.

Inherently, most plastics have low thermal conductivity, which creates a problem when plastic tools are used at relatively high temperatures. To a minor degree, the thermal conductivity of cast plastics can be controlled through the selection of appropriate fillers, such as powdered copper, powdered iron oxide and powdered aluminum. In general, thermal conductivity is not significantly improved unless the filler comprises at least two-thirds of the weight of the mixture.

If it is impracticable to use fillers to change the properties of plastics, the resin manufacturer should be consulted. Special compounding methods by the manufacturer may result in production of a resin with the desired properties.

Understanding the physical properties of plastics is essential to their intelligent application in tooling. The availability of plastics with different physical properties and the ease with which some of these properties can be modified by the toolmaker, make plastics versatile and desirable tooling materials.

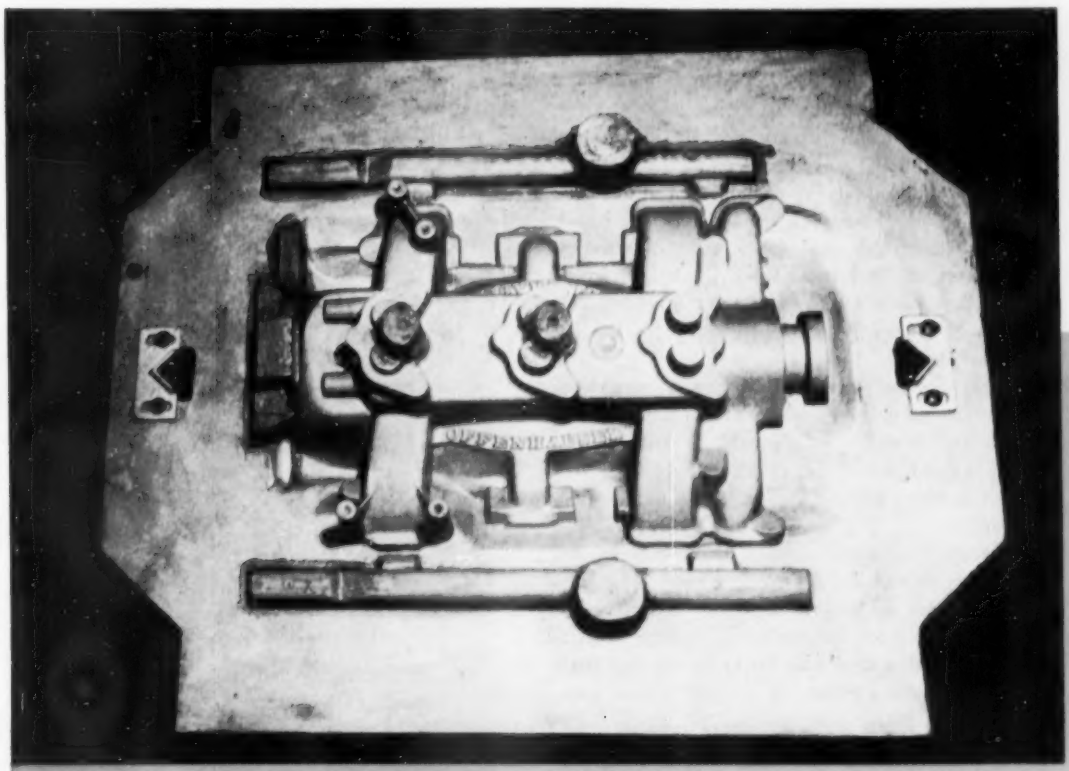

Fig. 3. Good abrasion resistance is required of plastics used for patterns, core boxes and other foundry applications. This match plate of a special Ford Thunderbird head was made by Dependable Pattern Co., Los Angeles.

How To Reduce Chatter During Shaving

By Porter Hardman
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CHATTER IS AN INHERENT problem in any shaving operation but it is particularly apparent in fine shaving or where large areas are involved. It is a condition of resonant vibration in which the cutter and workpiece move with respect to each other at a frequency that is usually determined by the natural frequency of one or more elements of the machine. When the condition has been established, interaction of the cutter and workpiece sustains it. This condition can result from any of a number of different causes such as looseness of the workpiece in its mount, worn parts, looseness of the toolholder, proportions of the workpiece and distance of the cut from the spindle.

Chatter can be minimized by careful setup and periodic machine tool maintenance. Chatter will still remain, however, and should be damped out, *Fig.* 1, if good production results are desired. Undamped chatter caused a lot of trouble on one production run.

High reject rates and manufacturing expenses resulted from chatter during the shaving of head closure sleeves for the motors of Mighty Mouse aerial rockets. The sleeves, 2.6 inches in diameter by 2.5 inches in length with a wall thickness varying from 0.15 to 0.35 inch, are shaved on an 8-spindle automatic screw machine.

It was noticed that chatter was most severe with a newly sharpened tool. Production personnel reasoned that this phenomenon resulted because, with a sharp tool, little pressure was required to cut the metal. As the tool became dull, more pressure was required, for the cut and chatter was reduced noticeably.

The first solution was to purposely dull the tool on an India stone. Crude as this method was, it did enable production for some time. To effectively dampen the chatter, approximately 80 percent of tool life was sacrificed. With the reduced tool life, shaving tools had to be changed three times during each shift. The cost of removing the tool and sharpening it, coupled with the loss of production and

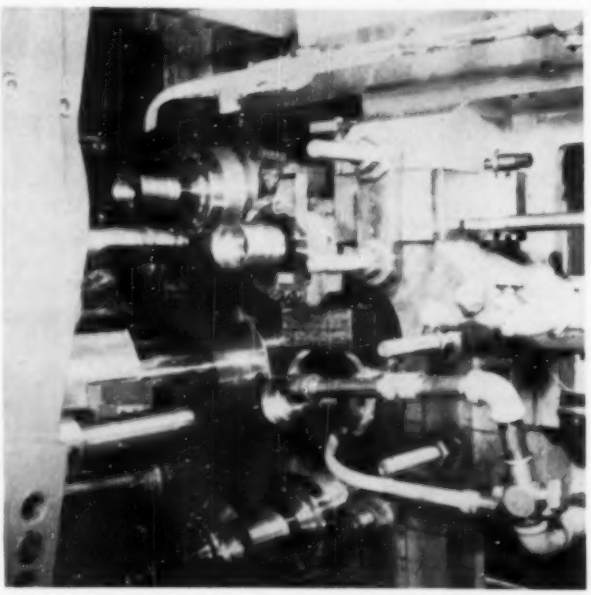


Fig. 1. Chatter was a problem on this automatic even though the machine was in good condition. A lead weight, suspended below the tool, successfully damped the vibration.

labor time, and the loss of two or three workpieces while readjusting a sharpened tool, totaled about $10 per change.

Since the dull-tool solution was not satisfactory, work was continued to determine why sharp tools chatter. During chattering, there is a bouncing effect between the workpiece and the tool. These bounces or vibrations maintain a regular pattern under a specific set of conditions.

The next attempt at a solution was to weight the toolholder to increase the tool pressure. Since lead has high density, it was hoped a lead weight would absorb the vibrations. A lead block, weighing between 2 and 3 lb., showed some improvement but not enough to be counted as a solution.

The next idea tested was the suspension of a lead block by springs from the bottom of the tool mount. It was thought that this would give additional cushioning plus the necessary tool pressure. The effect was the same as when a weight is held on the end of a spring and the other end of the spring is held in the hand. When the hand is moved downward, the weight will move up toward the hand.

Since chatter is caused by vibrations of a given amplitude and frequency, it is possible, where conditions will be constant as during a long run, to reduce chatter by creating an equal but opposite amplitude at the same frequency. A 9-lb block of lead, about 2 by 3 by 4 inches, was found to be the optimum size for this setup. It is suspended from the tool mount, *Fig.* 2, by cap screws and springs.

Dramatic results have been shown in production records. After the lead block had been used for 49 days, production records for that period and for the 49-day period just before introduction of the lead block were compared.

Before the damping block was installed, 8.7 percent of the pieces were defective but salvageable and 3.1 percent of the pieces were scrapped. After installation of the block, 1.7 percent of the sleeves were defective but salvageable and only 0.1 percent were scrapped. Total production was increased by 27 percent, without including salvaged sleeves. This production increase was brought about by the reduction of down time. Instead of the three tool changes per shift that were necessary before damping, tools are now changed just twice a week.

Dollarwise, these improvements mean a saving of about $60 per week in the cost of work scrapped or salvaged. Other savings include $75 per week resulting from increased production and $13 per week due to longer tool life. This successful solution to the problem of chatter during shaving operations represents a total saving of about $148 per week.

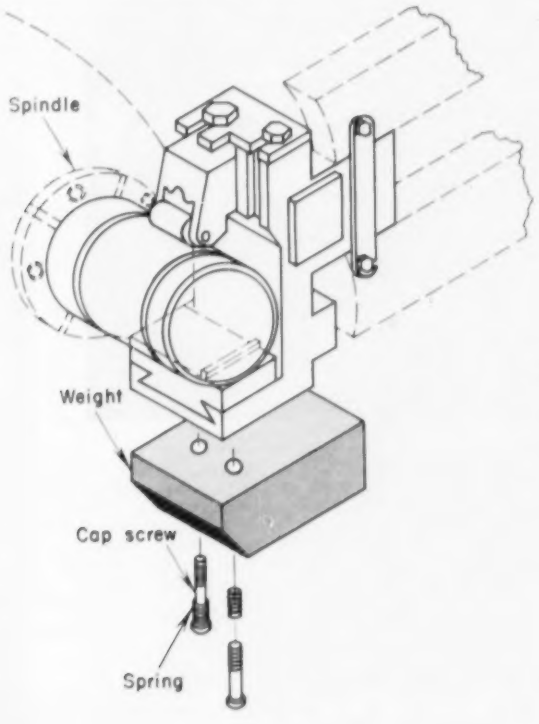
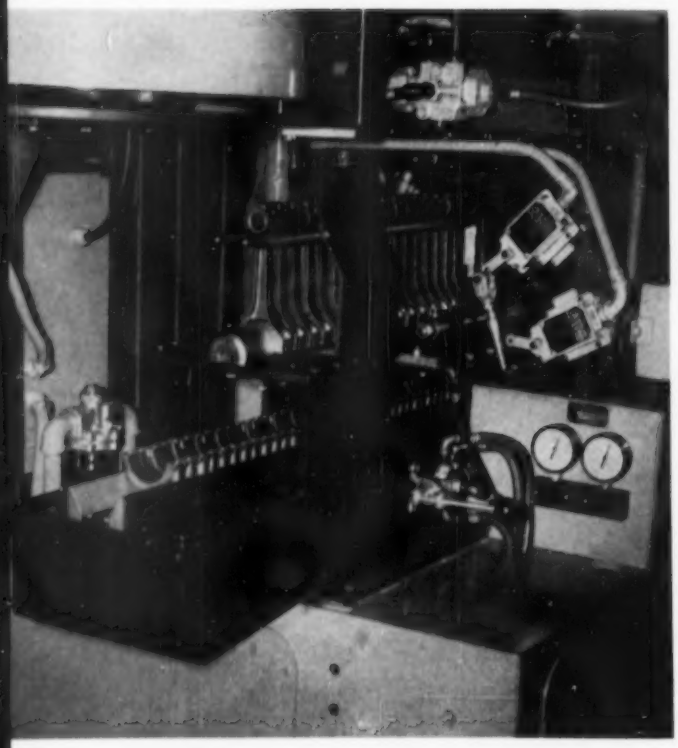


Fig. 2. By suspending a lead weight of the proper dimensions from the bottom of a shaving-toolholder, chatter vibrations can be damped to improve production.

designed for

PRODUCTION

Machine Automatically Assembles Connecting Rods and Caps

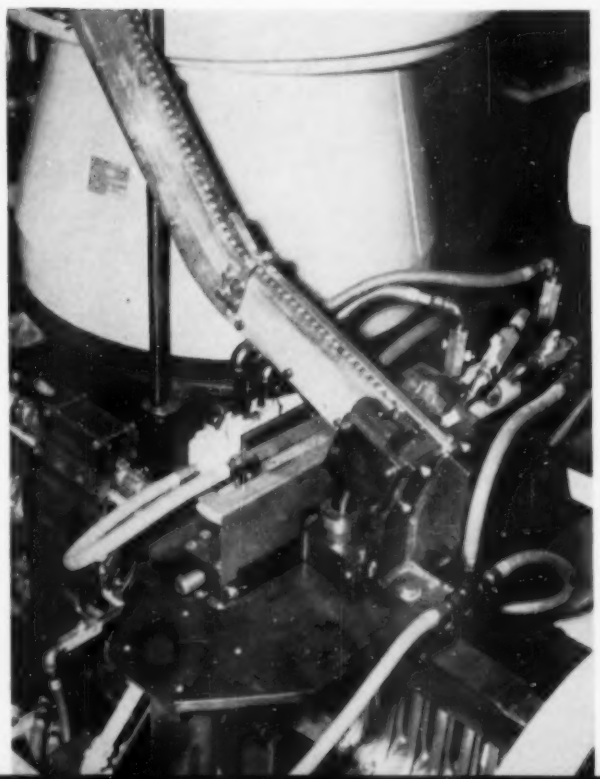


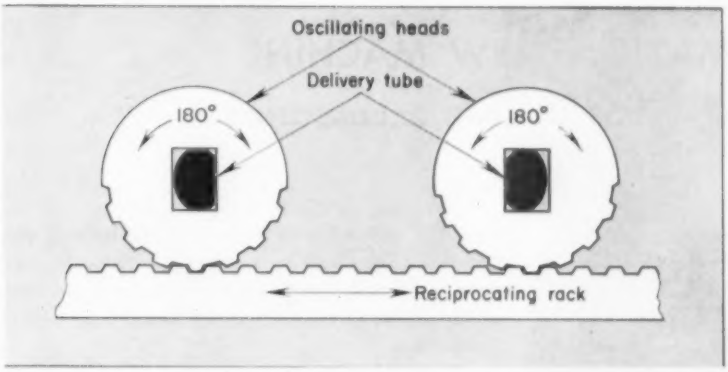
CONNECTING RODS are manually loaded (above) on one set of bars of a magazine and caps are manually loaded on parallel rails of the same magazine. The magazine is lifted and carried forward at each index until the rods are engaged by the positive index mechanism. Caps are moved within the magazine until they are automatically engaged with the rods.

BOLTS are fed by a vibrating hopper (right) to a feed chute. At the end of the chute, a feed splitter positions one bolt over each connecting-rod hole. Before the bolts can drop down a tube and into the bolt holes, the asymmetrical heads must be oriented.

This straight-line transfer machine can assemble connecting rods and caps at a production rate of 700 per hour. Air is used as the power source, with electrical control. An operator loads caps and rods in a magazine, although this task can be made automatic, and the machine automatically orients bolts, inserts them, presses them home and torques holding nuts.

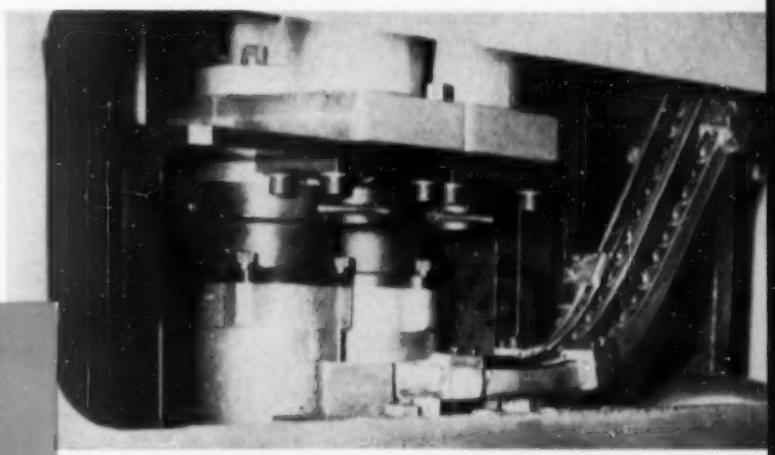
Proper torquing of the nuts is achieved by this Ingersoll-Rand machine by using the correct size of air motor and adjusting air pressure. The nut-torquing motor is run to a stall and nuts are uniformly tightened.

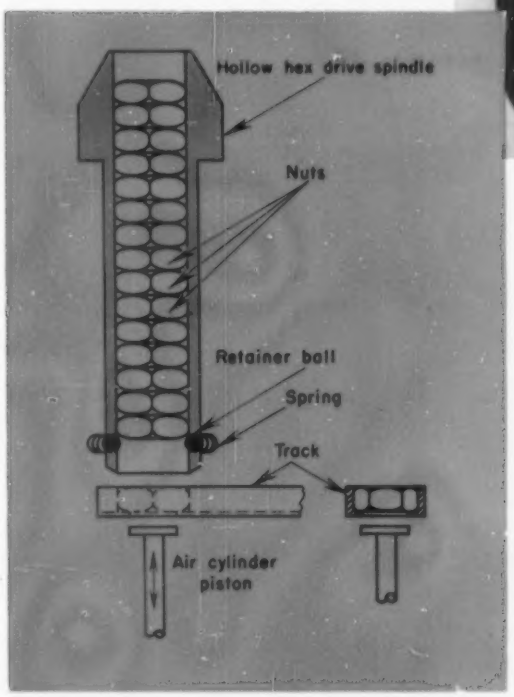




ORIENTING device lines up bolt heads with delivery tubes. Rack is powered by a reversing air cylinder. This design is good because the air cylinder causes a jerk to rattle the head within the rectangular cut-out. Also, the time required for reversing the air cylinder allows the bolt to fall free.

NUTS are removed from a hopper by herringbone elevator and slide down gravity tracks to insertion stations under the air-motor spindles.





INSERTION of the nuts into the hollow spindles is accomplished by an air cylinder escapement. Spring-held balls retain the nuts in the spindle. Rotating unit is raised until nut contacts bolt. Rotation is continued until the air motor is stalled, which point is regulated to give correct torque. Spindles drop before the next index.

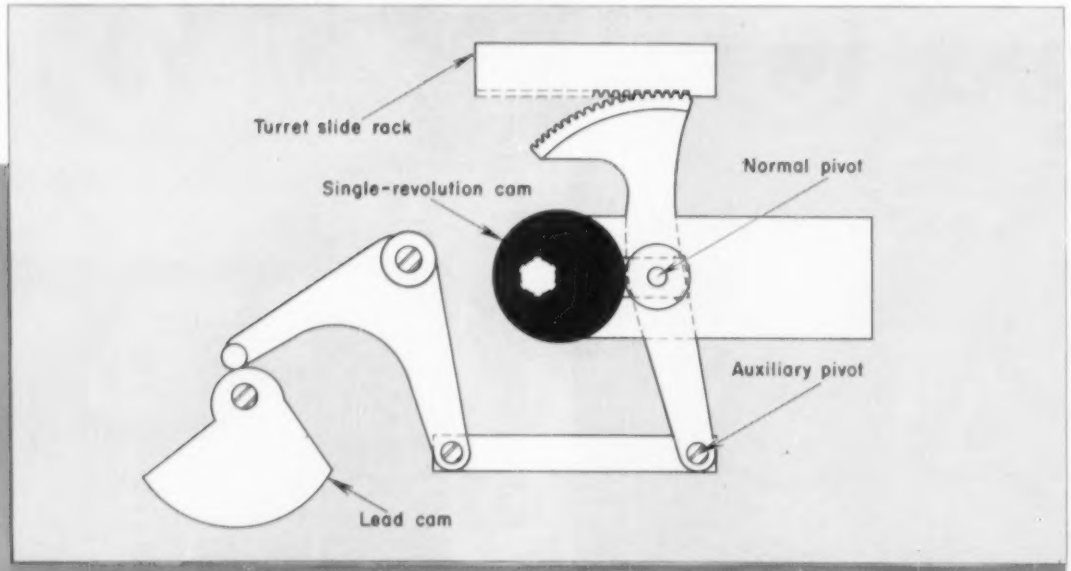
NUT-RUNNING station can be rolled out of the machine for convenient servicing. The heavy pressing station is also mounted on wheels.

AUTOMATIC SCREW MACHINE
has built-in accessories

After determining what accessories were normally bought for use with automatic screw machines, B & S engineers designed many of them into the No. 2 automatic screw machine. A vertical slide with a quick-acting tool clamp, for example, is standard equipment on this machine. Also, the turret can be indexed through two positions in the same amount of time it can be single indexed. Two or three turret tools can be mounted in alternate holes without loss of productive time in the cycle and without the necessity of duplicate tooling.

Another design feature of this Brown & Sharpe Mfg. Co. automatic is a chisel-point locking pin that holds the turret in working position. In contrast to conical pins, chisel-shaped pins can seat solidly in the turret bushing without precise radial positioning.

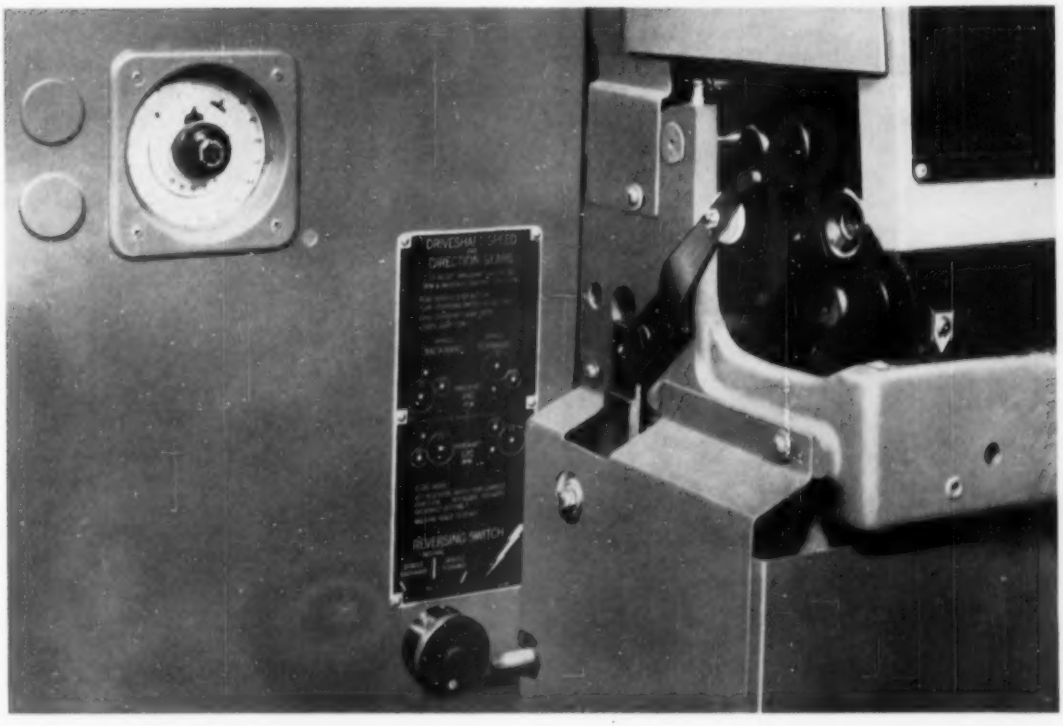
An integral rapid pull-out device in this machine reduces the time required for drilling small, deep holes. The device withdraws the drill several times during the operation to clear the chips and lubricate the point. With this device, only half the cam surface is required to accomplish pullout as was formerly needed.



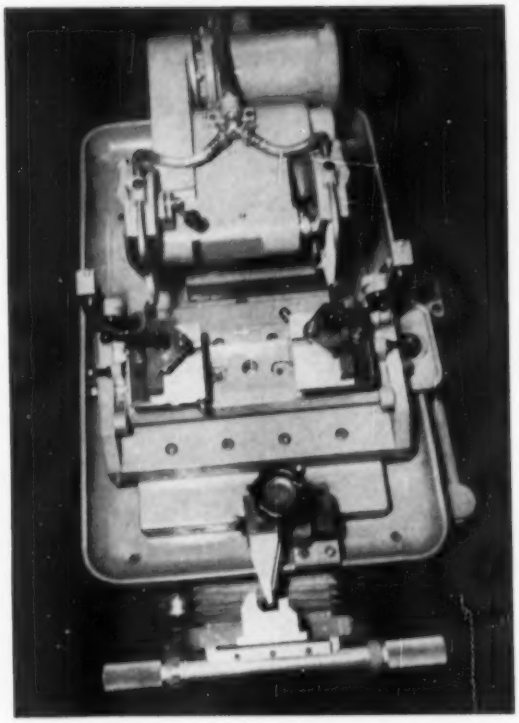
LEAD MECHANISM has been designed to rapidly withdraw drill without wasting time or cam surface. Key point of the mechanism is a pivot for the gear segment. When turret tools are cutting, the pivot is stationary and motion is transmitted directly from the lead cam to the turret rack. When an index or rapid pull-out is desired, the cam in contact with the normal pivot rotates one revolution and moves the pivot forward and backward. At any time, a trip dog can initiate the one-revolution movement of the cam. In ½ sec, the time for a normal index, the turret slide is withdrawn and advanced a distance of 2½ inches. Different stroke length can be achieved depending on the throw of the cam.

WITHDRAWAL may include an index of the turret or not, depending on shape of this rapid pull-out disk cam located on the back end of the lead-cam shaft. A rise on this control cam declutches the drive to the turret-slide index crank and no index occurs. A drop on the cam re-establishes the drive and an index occurs after the withdrawal.

POSITIVE STOPPING of this automatic (below) takes place when there is no more bar to cut. A nylon roll or shoe presses against the stock at the end of the feed tube. When the lever drops down, it actuates a preset counter. Each subsequent movement of the feed slide registers one count and when the number of counts preset on the dial is reached, the machine stops and a signal lamp is lighted. The preset count is determined by the number of pieces that can be safely made from the bar end.

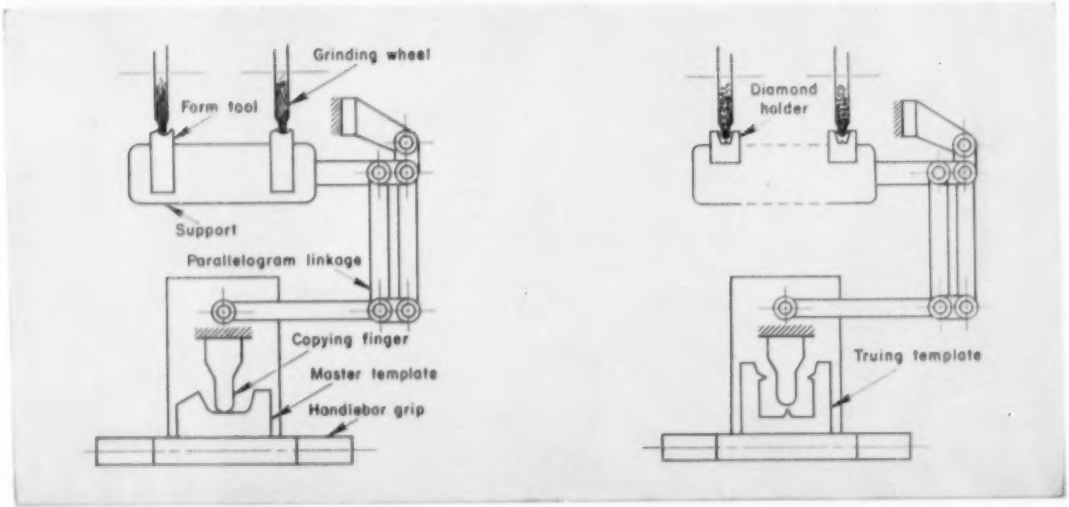


Duplicate-Tool Grinder Controlled By Oversize Template



Flat profile lathe tools and production parts can be ground two at a time with this twin-wheel grinder. High accuracy is possible because the control template is five times as large as the workpiece. This machine can be used as the heart of a duplicate-tool system that reduces production-tool down time. Since the two tools are identical, one is used while the other is reconditioned to correct form. These Swiss "Copyrex" machines are handled by Carl Hirschmann Co., Inc., in the United States.

TILTING TABLE makes possible the grinding of vertical and lateral relief angles on the duplicate tools or parts. Clearance angles can also be varied by tilting the table. The inclined position of the tool, necessary for attaining clearance angle, could cause profile distortion. By tilting the template to the same angle, however, the profile is automatically corrected without calculation. This is the operator's view as he manipulates the handlebar.



TWIN TOOLS are ground simultaneously by guiding a template along a stationary copying finger. Movements are transmitted, with a reduction of 5:1 through a parallelogram linkage to the toolholders. Parallelogram links are carried on ball bearings.

WHEEL TRUING is accomplished by using a three-point template and two 3-diamond truing devices. The truing template is 90 deg out of phase with the production template. Diamond holders are hinged at the sides of the toolholders for quick change-over.

Standardized Electronic Circuits can save industry money

INDUSTRY CAN LOOK forward to more reliable and less expensive electronic circuits if continuing work at the National Bureau of Standards is followed through by manufacturers of electronic controls. NBS engineers have found that it is feasible to standardize many of the electronic circuits used in aeronautical equipment. A standardization program, undertaken by NBS for the U.S. Navy Bureau of Aeronautics, is determining electronic circuits that are common to a wide variety of devices but that unnecessarily differ in detail. This continuing investigation should result in important economies in critical engineering man-hours and in lead time, and could accelerate production.

When such preferred circuits are available, military services will be able to simplify maintenance training while improving operational reliability, and may be able to design simple "throw-away" units and establish design standard levels. These objectives can be achieved without loss of design flexibility because rigid compliance with the preferred circuits will not be required. The circuits would be used as design guides only. This program, under the supervision of J. H. Muncy of the NBS engineering electronics laboratories, is restricted to military equipment but the techniques will be applicable to industrial electronic equipment, with similar benefits. The Bureau is cooperating with industrial groups studying the same problem and is exchanging information with them.

Circuits of aeronautical electronic equipment are necessarily complex, comprising hundreds or thousands of individual components connected by a maze of wire. As with any complex equipment, such a circuit is a composite of many subcircuits, most of which are known and used in different combinations in other equipment.

For example, most aeronautical electronic equipment includes rectifier circuits and many have amplifier, timing and other similar circuits. Although some subcircuits are unique, the great majority of them are widely used. Such subcircuits are the building blocks of electronic equipment.

Many electronic building blocks have been accepted for their general functions and circuit arrangements but no attempt has been made to standardize their exact circuit configurations, *Fig.* 1, or the resistance or capacitance values of their components. Engineers recognize that one of the great advantages—for both design and production—of electronic techniques is the flexibility of circuits. They would be reluctant to surrender any part of this flexibility except for great compensating advantages. Preliminary phases of the NBS program have shown that advantages would result for both the user and the producer of equipment with standardized circuits.

To the military services, such standardization would mean lower purchase prices, shorter delivery times, greater operating reliability, fewer spare parts at field installations and simpler maintenance. For the producers, there is the prospect of economies in design and production engineering. Production will also benefit from fewer designs and reduced inventories.

The initial feasibility study covered 22 pieces of aeronautical electronic equipment. These included several radar sets, an indicator assembly and radio equipment. The over-all circuits were divided into functional subcircuits and then systematically analyzed to determine subcircuit similarities and differences. The results showed that the 22 pieces of equipment basically were made up of 60 subcircuit types. Although the subcircuits falling within a given type are not identical, standardization is feasible. For example, certain range-marker generator circuits can be identical for many of the radars and for other time-scale indicators.

The extent to which an over-all equipment cir-

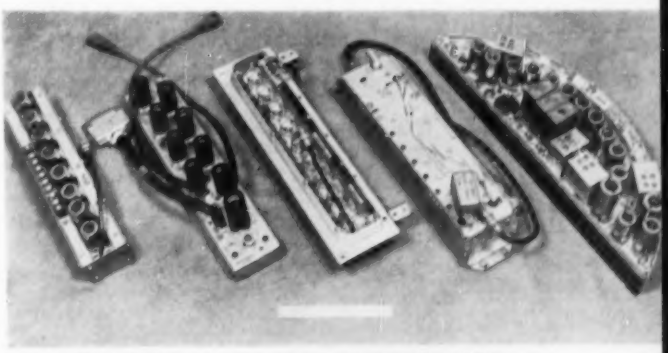
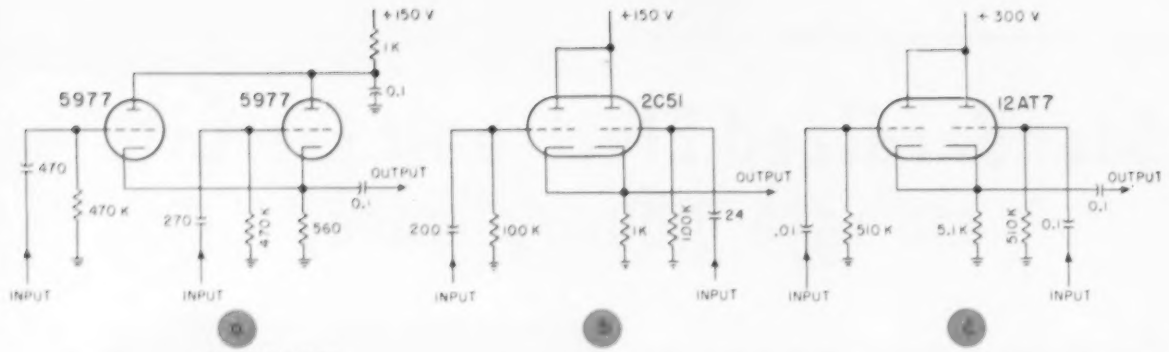
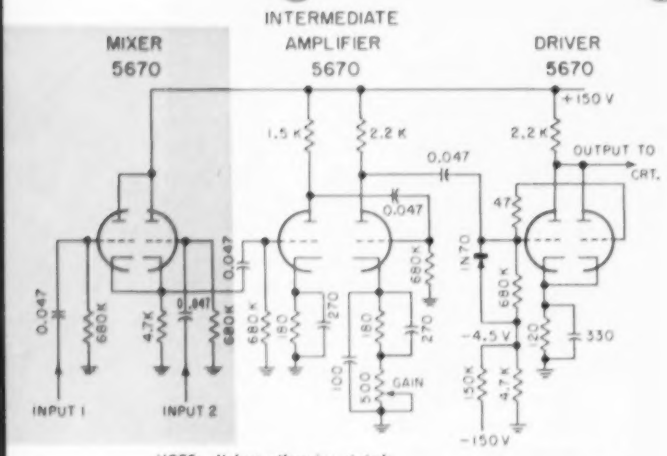


Fig. 1. Five electronic component strips produced for Navy aeronautical equipment illustrate wide variation in size, shape and circuitry. All perform the same electrical functions.





NOTE: Unless otherwise stated:
R in ohms; $C > 1$ in $\mu\mu f$; $C < 1$ in μf; L in μh

Fig. 2. Representative examples of video mixers combine pulse information for special applications: (a) common-cathode mixer combines pulses representing range markers and heading markers; (b) common-cathode mixer combines two positive polarity range strobe triggers; and (c) combines 9-volt positive polarity range markers with 2 to 10-volt positive intermediate frequency signals. Preferred circuit that meets the requirements of these applications is shaded in the first or mixer stage of the circuit shown at upper left.

cuit can be standardized is expressed as a ratio of the number of vacuum-tube cathodes in standardizable portions of the circuit to the number of cathodes in the entire circuit. Cathodes are counted rather than vacuum tubes to avoid the ambiguity that would result from such items as double triodes. On this basis, the feasibility study of the 22 pieces of equipment showed that 50 to 70 percent of the cathodes could be standardized. The remaining cathodes were in special circuits.

A video chain for a radar system, *Fig.* 2, represents a typical preferred circuit. It mixes the radar video signal with marker pulses and then amplifies the combined signal to intensity-modulate the cathode-ray indicator. Not intended for a specific application, this circuit will serve as a convenient guide when the video section of a radar set is designed. Component types and values have been chosen so the circuit can be made mechanically or by conventional production methods, *Fig.* 3.

The most promising field of standardization is in power-supply circuits. These were considered standardizable in all of the tested equipment. The first step in refining these circuits was the reduction of the number of voltages. Voltages in 20 pieces of equipment had 20 different nominal values. The number was reduced to four.

In determining preferred circuits, priority has been given to the more widely used and more easily standardizable items. Theoretical and experimental studies of the known versions of a subcircuit establish a "least common denominator" circuit. The preferred circuit is usually chosen from one of the existing designs, with variations allowed by prescribed component value changes. As a result, the circuit is capable of equaling the performance while avoiding the faults of a large number of original versions. New circuits have not been created.

As industry tends more to automatic production and assembly at ever higher speeds, electronic controls become increasingly important. The training of operating and maintenance personnel is going to be more important. Anything that can be done to increase the reliability of control equipment and at the same time time reduce maintenance problems will mean better production at lower cost.

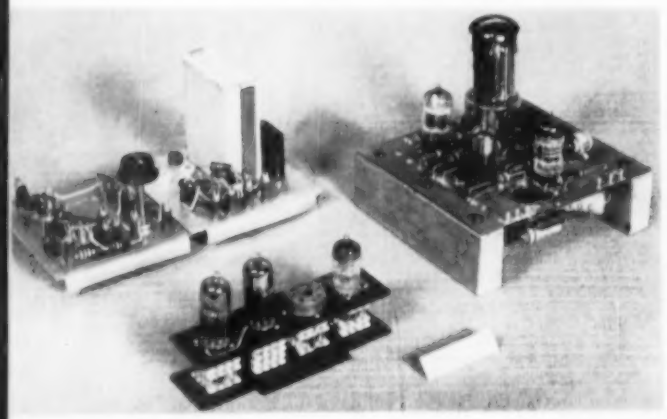


Fig. 3. Standardized circuits are readily adaptable to such different construction methods as mechanized production, printed circuitry or laboratory breadboard techniques. Different preferred circuits built by these three different fabrication techniques are shown.

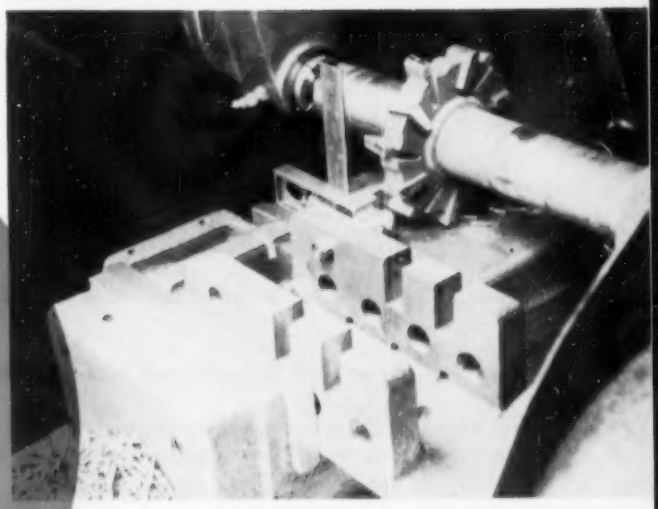


Fig. 1. Typical small-lot set-up, as recorded by camera.

Camera aids small lot tooling

By J. H. Sperman*
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WHEN SEVERAL NEW items were added to the company's product line, the result was an increase of several hundred production operations. Most of these are scheduled only a few times a year. Tooling must be simple and may be devised in the shop. The best setup is usually a matter of trial and error. To save time and reduce errors in repeating the setup later, a simple but effective record system was needed. The first idea tried was to make a sketch of the machine setup on each operation but that took too much time. A photograph of each operation seemed to offer better possibilities, *Fig.* 1.

After some experimenting the company finally selected a 3½ x 4¼-inch Speed Graphic press camera for this purpose, although a good film-pack camera might also be satisfactory. A heavy tripod, 10-inch clamp type reflector and a one-minute timer were also secured. A 60-watt bulb is used in the reflector.

Using the regular lens it was found that most pictures must be taken close up, at a distance of no more than two or three feet in order to show the essential details as large as possible. To focus correctly at this distance it was found that a camera with ground-glass focusing was needed.

The method of recording a machine setup is as follows: the camera, which is kept in readiness mounted on the tripod, is set up and focused on the operation through the ground glass. To do this the lens shutter is set on time and opened, while the lens itself is opened to its maximum. When the tooling is in focus and shows exactly what is wanted, the shutter is closed and the lens is set at f:22. This assures that everything from a foot before the focal point to two feet behind it is in sharp focus. The film is then inserted in the camera—in a press type camera the film holder is slid into place without disturbing anything. A medium speed film, such as Plus-X, is preferred, as it gives better contrast and detail.

Next the timer is set for one minute or a half-minute if there is plenty of daylight, although fifteen seconds more would be all right. Finally the shutter is opened, the timer started while the reflector is waved over the work, painting it with light. The main features are emphasized by bathing them with more light. This painting technique removes the

*Senior member ASTE Greater New York chapter.

UNIT Stock Straightener
PART 2" Body
OPERATION # 14 TIME 1 min.
MACHINE Lg. Mill Mach
SPEED 75 RPM FEED 4" Per
TOOLING 4"x1" Cutter Locating Jig

Fig. 2. Form giving details of operation is stamped on back of print and data is recorded.

heavy shadows from the sides and back of the work.

After the minute's exposure the shutter is closed; the negative is ready for developing and printing. The entire operation, from getting the camera from the office, taking the picture and putting the camera back in the office averages about eight minutes.

After the picture is developed and printed a form is stamped on the back, which gives all the main details of the job, *Fig.* 2. Since this system was started hundreds of pictures have been taken. It is estimated the system has saved at least a thousand dollars in production time by eliminating spoilage and errors in machine setup.

The camera is also used to take pictures of the finished part. An enlargement is made and all dimensions marked on the print. Often this is simpler than making a drawing, especially when a series of drawings would have to be made, with only a few sizes or specifications recorded on each. The method is also used in making records for repairs, in ordering repair parts and for similar purposes.

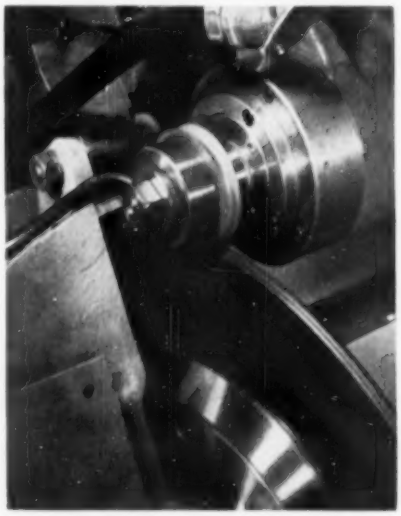
Grinding Wheels from Diamond Powder

RECENT development of cemented diamond particles offers industry a means for continuous form control of grinding wheels. The process grew out of five years' work by Jones & Lamson Machine Co. and Koebel Diamond Tool Co. to devise a method of utilizing the hardness of diamond in its most economical form—diamond powder. Result is a powder metal cutter body. Tests indicate the cutter has ability to reshape and resize wheels faster than previously possible. Reshaping and resizing can be continuous or intermittent. Apparently thousands of pieces can be produced on the new grinder with no attention to the cutter-dresser. A production job using a single cutter created by this method now has been in continuous use for more than a year. During that period there has been no change in accuracy of the parts produced. Narrow dimensional limits can be maintained and surface finishes down to 30 rms can be achieved.

Grinding wheel equipment required consists essentially of attachments to existing machine designs. The cutter which maintains the wheel acts similar to a milling cutter with thousands of cutting teeth set in the body in such a manner as to continuously generate an accurate form. The cutter is motor driven in contact with the wheel at a speed somewhat higher than that of the wheel. Coolant is supplied at pressures of approximately 25 psi, which is of sufficient velocity to carry off abrasive grit and bond and to keep the grinding wheel surface open.

The cutters can also be used to shape grinding wheels directly from solid, while wheels can have forms removed with the cutters before cutting new forms in them. A $\frac{3}{8}$ in. deep form, 2 in. wide, can be removed in less than 5 minutes.

Closeup of the Koebel cutter using fine diamond particles in the powder metal cutter body.



Automated Spot-Welding Machine

improves productivity and quality

By Jerome D. Pinsky
District Manager
Sciaky Bros., Inc.
Chicago, Ill.

Many tool engineering problems can be most effectively solved when the specialized knowledge of a machine builder and the production know-how of plant personnel are combined. Working together, engineers of Sciaky Bros., Inc., and Radio Steel & Mfg. Co. of Chicago developed a highly successful automatic method for fast spot welding of coaster-wagon wheels.

COASTER-WAGON WHEELS made by Radio Steel & Mfg. Co. are fabricated from two identical stampings, four inches in diameter and 0.035 inch thick. These are spot welded together on an automatic machine, *Fig.* 1, to form the wheel, *Fig.* 2. A rubber tire is snapped on the wheel in a subsequent operation. Production rates of 2800 units per hour are maintained.

At one time, the wheels were welded by single-spot methods. The two wheel sections were assembled in a small jig, using the axle hole for alignment, and manually welded at four points.

The production rate varied with the skill of the operator, ranging from 600 to 800 pieces per hour. Spacing of the spots was irregular and weld quality was not consistent. It was necessary for the operator to redress the electrode tips frequently, which slowed down production.

Because of these disadvantages, a study was made to determine if an improved welding method, from the standpoints of productivity and quality, could be developed. Minimum production rates were established at 2500 pieces per hour, which immediately ruled out manual single-spot welding methods. Accordingly, the decision was made to use an automatic machine for welding. After evaluating several automatic production methods, it was determined that one high-speed indexing dial machine would be capable of maintaining desired production rate.

With a machine type selected, the next problem was selection of a suitable resistance-welding process. Consideration was given to both projection welding and multiple-spot welding. Initially, pro-

Courtesy Radio Steel & Mfg. Co., patent pending.

Fig. 1. Dial-feed machine for spot welding coaster wagon wheels. Eight electrodes weld two wheels simultaneously. Loading, welding, unloading are automatic.

Fig. 2. Coaster wagon wheel is made from two identical halves, spot welded together in four places.

jection welding looked like the better choice. With this process, four projections could be placed in one wheel segment during the blanking operation. Two annular ring dies could be used as welding electrodes. Dies of this design have long life because pressures are distributed over a large area. Stoppages for redressing electrodes are unnecessary, making uninterrupted production runs possible.

Further study, however, pointed up several disadvantages of projection welding for this application. Approximately 5000 stampings per hour were required to supply the welding machine with parts. If projection welding were adopted, half of these stampings would have welding projections. Keeping the parts segregated during a continuous degreasing operation which preceded the welding operation would have been difficult.

The possibility of making both wheels identical by placing two projections on each wheel half was also considered. For maximum wheel strength, however, it would have been necessary to position the parts carefully so that projections were evenly spaced. This location problem would have made it difficult to automate the welding machine.

The location problem could have been largely eliminated by putting four projections in each part, thus increasing the number of contact points. If this had been done, however, more power would have been required to make the welds; a larger machine would have been necessary; and the results would still not have been entirely satisfactory.

Further studies made it apparent that heat distribution in the annular ring dies would be poor. For satisfactory projection welding of the parts in question, concentrating the heat in individual electrodes, one electrode for each projection, would give better results. Also, individual electrodes would provide a uniform and equal pressure at each point of contact.

With individual electrodes, one of the major advantages of projection welding—the use of the simple annular ring die—would have been prevented. A complicated, self-equalizing upper die, made up of individual welding dies, would have been required.

For this reason, multiple-spot welding methods were eventually chosen. Spot welding avoids the need for projections; hence, there is no difficulty in locating the parts for welding.

The welder selected operates off single-phase alternating current. Both direct and indirect patterns of current flow were studied, *Fig.* 3. With direct welding, it would have been necessary for the indexing table to carry the welding current. The design and construction of the electrical components required to carry the current from a rotary to a stationary member would have added substantially to the cost of the machine.

Consequently, indirect series welding was adopted, making it unnecessary to carry current through the machine table. The welding head was designed with transformers close to the work, using a short secondary loop. The secondary loop raises the power factor from a nominal 30 percent, which might be expected with a conventional single-phase a-c welder, to well over 60 percent.

If direct welding methods were used, the calculated power requirements would be in excess of 600 kva. With series indirect welding, using closely coupled secondaries, actual instantaneous peak demand amounts to only 108 kva, a large saving in power. The indirect series welding method also allows for more equal distribution of the secondary current, assuring that the nugget size and strength of each weld is identical.

Two 50 KVA dual-secondary transformers are used, each having four terminals. The secondaries of the transformers are connected to individual silver-plated leaf laminated shunts, which are fastened to the electrode adapters. Eight 500-lb capacity double-acting air cylinders are used as a pressure medium to apply electrode force.

With the welding method established, the next problem was the design of a suitable dial-feed mechanism. Most dial-feed units available employ a Geneva mechanism. This type of mechanism is not well suited to welding machines, since it does not permit a variable dwell-to-rotation time.

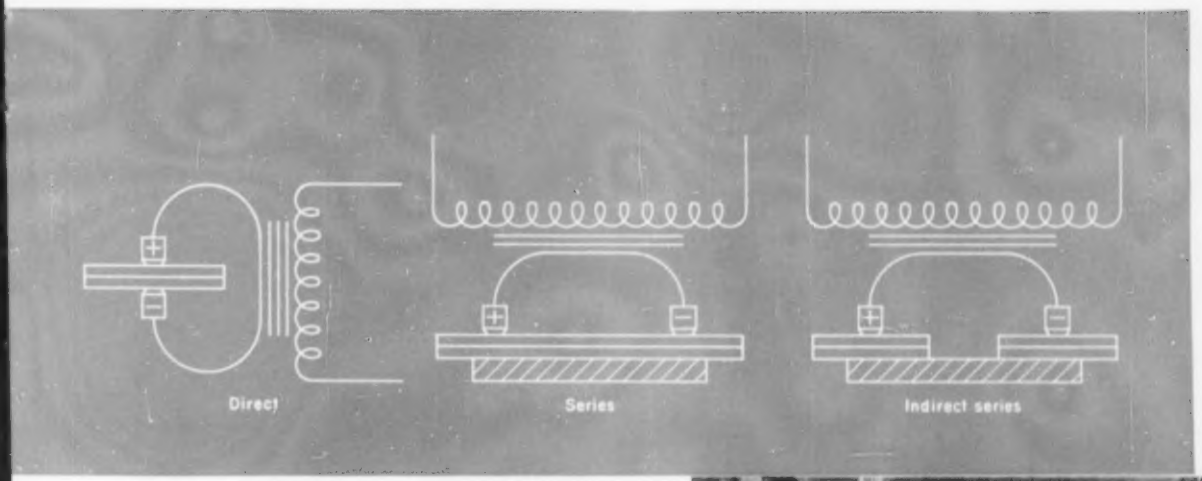
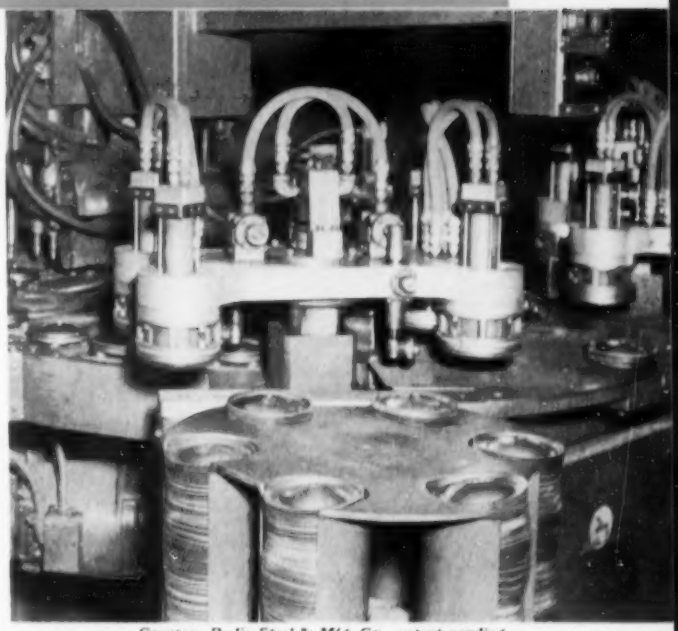


Fig. 3. (above) With indirect series welding, right, welding machine construction is simplified since current does not pass through machine table.

Fig. 4. (right) Loading mechanism at halfway point during transfer of parts from magazine to machine table.



Courtesy Radio Steel & Mfg. Co., patent pending.

Accordingly, a special dial-feed mechanism, operated by a three-phase a-c motor connected through a speed reducer to the subplate of the dial feed, was designed. This indexing mechanism provides the required variable rotation-to-dwell time. A special control system was also designed. It includes a signal system to initiate table rotation at the end of the welding sequence, as well as controls for the welding sequence.

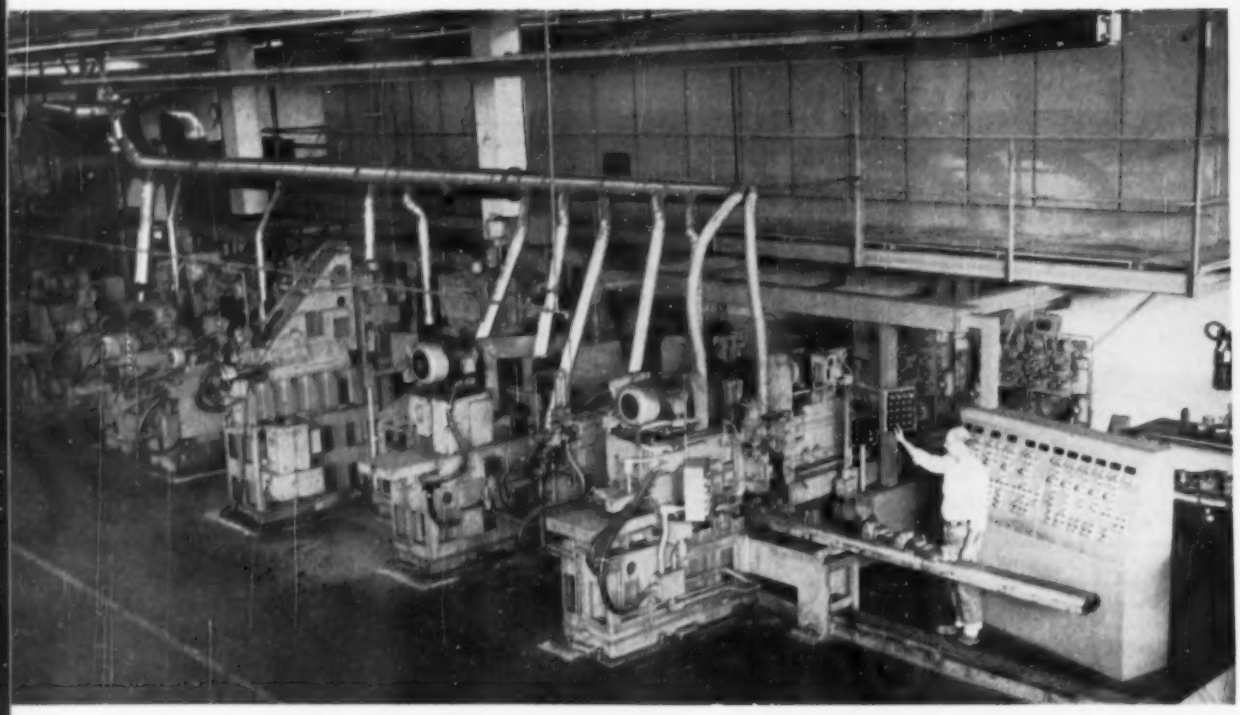
The welding sequence consists of: "squeeze," "weld," "hold" and "off" times. A system of phase-shift heat control allows continuously variable adjustment of the amplitude of the welding current between the taps on the transformer.

When the machine was constructed, welds were made at a production rate of over 2800 complete wheels per hour. It was impossible for an operator to load and unload the machine at this rate. Development of loading and unloading devices was mandatory.

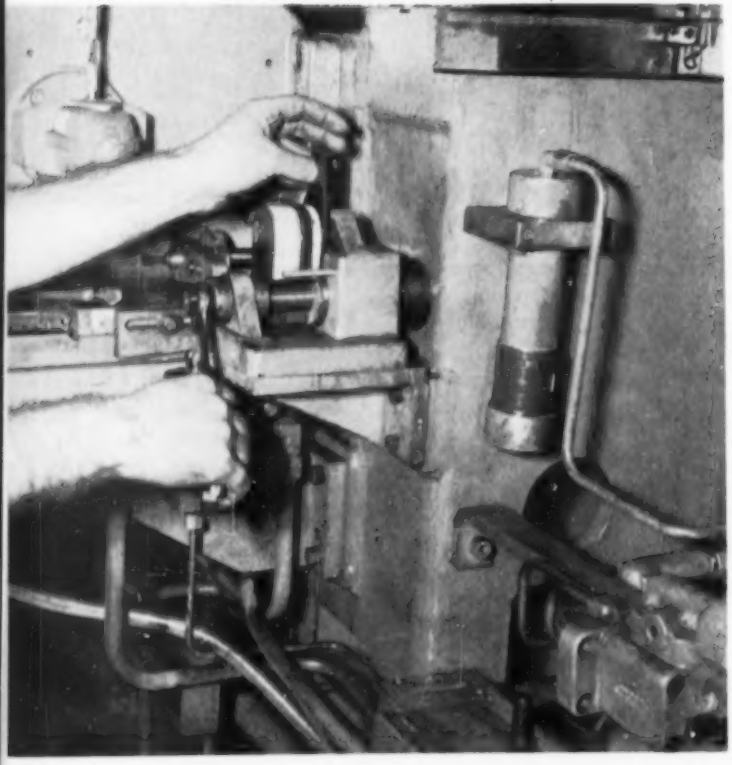
The loading method developed by Radio Steel & Mfg. Co. engineers is illustrated in *Fig.* 4. There are two identical loading mechanisms, one for each wheel half. Essentially, the loading mechanism consists of a rotating arm equipped with permanent magnets and air cylinders. In operation, two wheel halves are picked up simultaneously from a magazine. The arm then rotates 180 deg, positioning the parts over locating pins in the machine table. Ejector pins, actuated by the air cylinders, push the two wheel halves onto the locating pins. Loading, welding and unloading operations take place with the machine table at rest. The loading magazines are kept full by the machine operator.

Unloading is accomplished by a pair of powerful permanent magnets connected to a cross arm and air cylinder, in turn connected to a lever beam. The beam is actuated by cam-followers on the underside of the machine table. With the arm in position over the machine table, the magnet is lowered by the air cylinder and picks up two completed wheels. The arm then carries the wheels over a tote box. Wheels are knocked off by a set of wiper arms as the cross arm reaches its outermost position. A limit switch stops the machine in the event that a wheel is not unloaded.

In production, the machine performs in a highly satisfactory manner. As has been shown, this successful operation resulted from long and careful study of alternate welding processes, mechanical aspects of the indexing machine, and automatic loading and unloading methods. Such planning pays off in terms of productivity and quality.



AUTOMATIC TRANSFER MACHINE has flexibility for machining motor frames in a range of sizes. Three basic frame diameters, each of two lengths with various mountings and types, which total 36 different units, are produced at Reliance Electric and Engineering Co.'s new plant in Ashtabula, Ohio. Changeovers are speeded by use of special accessories. The setup man repositions tools by removing or adding spacers (close-up). A check list is used to show correct spacer positioning. Time for complete setup varies from one to nine hours.



QUALITY CONTROL in a high-volume production plant is a critical problem, even with automatic control, largely replacing operator judgment. The final check at the Reliance plant is the run-in test given each motor at the end of the line. Many checks of individual parts and components precede this, under a strict statistical quality control program. (Close-up) Notching press operator inspects a lamination on optical comparator to check die wear, keeping bad parts off the line.

TOOLS at work

AIR POWER simplifies maintenance of large hydro-generators. Formerly 6 men and 21 hours were needed to remove the 5-inch nuts holding couplings on the drive-shaft, using a battering ram. With the compressed-air nutrunner, 2 men do the job in 1¾ hours, saving 19¼ hours' down time and 122½ man-hours.

TOOLS at work

ASSEMBLY of gage-plate mechanisms of slicing machines is speeded 200 percent with air screwdriver. When set-screws were installed by hand, an operator could work only one station. Now, three stations on various sub-assemblies are taken in stride in the new setup.

will automation pay?

By Raymond G. Rushing

Manufacturing Engineer
D-C Motor and Generator Dept.
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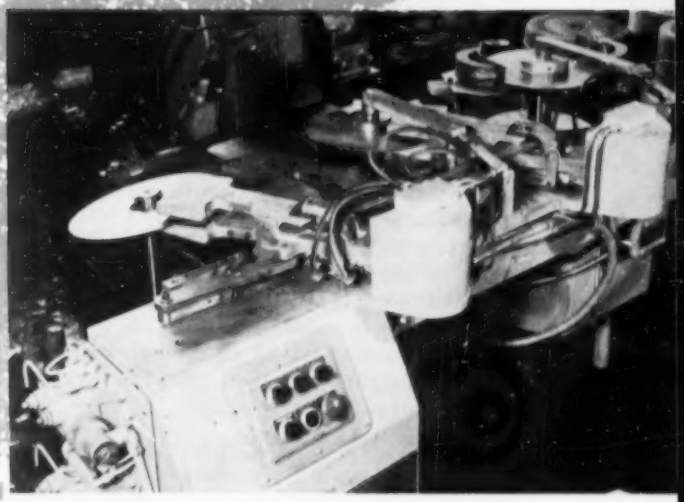


Fig. 1. Automatic notching press loader feeds parts into the press, cycles the machine and unloads it.

Management and tool engineers often are uncertain of where and how to approach needed process improvements. This article offers a down-to-earth procedure that will furnish specific answers in cost comparisons.

IN THIS ERA OF automation, the question of whether to automate or not to automate, or how far to mechanize an existing manufacturing operation confronts industrial management with increasing frequency. Often, the approach needed to arrive at a satisfactory answer to this problem is not clear.

When an attempt is made to evaluate the possibility of automating a manufacturing operation, *Fig.* 1, each operation must be separated and then analyzed according to its own characteristics. Nevertheless, the basic approach to the situation is similar in practically all process improvement problems. That approach is little more than application of common sense and attention to details.

Regardless of whether a manufacturing operation is simple or complex, some analysis is necessary in order to determine what can be accomplished by application of the principles of automation. The analysis becomes more complex as the number of operations in a particular manufacturing cycle increases, and this sometimes drives the analyst into confusion and frustration. As a result, there is a tendency to guess at the solution or else to declare that the answer cannot be determined.

There is a definite need for an analytical technique to determine in advance whether a particular manufacturing operation should or should not be automated. Through experience a method of analysis has been formulated that can be applied almost

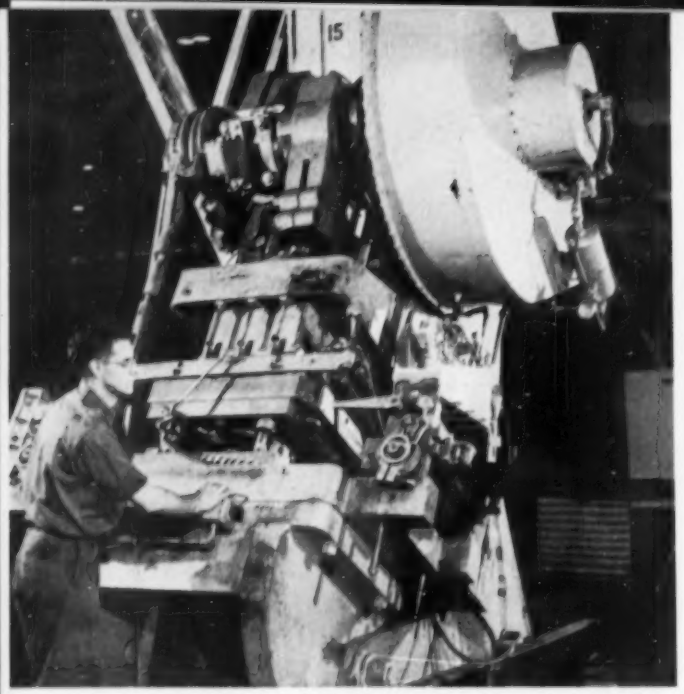


Fig. 2. Standard blanking press used to produce armature core lamination blanks.

universally to any manufacturing cycle comprising two or more machine operations. While this relatively simple method will quickly show the most desirable course of action, it still requires judgment.

The method is basically merely a simple, orderly reasoning process aided by the application of a few simple principles of mathematics. The necessary steps of the process are as follows:

1. Study and become thoroughly familiar with the operations in question
2. Assume the entire operation is completely automated, and/or partially automated regardless of how impossible such might appear
3. Analyze the time balance required between operations, based on existing equipment incorporating any known applicable automatic devices
4. Determine how many machines are required for continuous flow production
5. Determine the actual machine time required with existing equipment to perform each operation
6. Determine the total time presently allowed an operator to complete required operations
7. Determine any savings in manufacturing costs that might be realized through automation
8. Determine the cost of incorporating mechanization of each operation to obtain automation
9. Compare the savings in manufacturing costs with the cost of incorporating automation
10. Evaluate the automated setup and make a decision.

It is important that all steps of the process be completed even though one step might point out an unfavorable condition. The reason for this is that it might be discovered that partial, instead of complete, automation will be best for a particular manufacturing cycle or a particular operation.

To show how this analysis procedure works, an actual case will be considered using the method to analyze the operation. The production of sheet steel armature core laminations used in motors and generators, *Fig.* 2, is taken as the example.

While production figures, time standards, methods and wages given in this example do not represent actual information from any one firm, they are typical and will serve the purpose. Beginning with Step 1 of the analysis procedure, an investigation of the situation discloses that 17 different lamination blanks are produced in a variety of sizes and patterns and in quantities from 1300 to 8100. The total average weekly production of blanks is 70,000.

The number of notches required in each blank varies from 18 to 58, depending on the type of motor or generator to be manufactured. The notches may be one of 50 different shapes and sizes. One size blank may be used for as many as 15 different motors or generators. *Fig.* 3*a* shows a typical blank and *Fig.* 3*b* shows the blank after it has been notched.

Machines used for production of the laminations include a standard blanking press, *Fig.* 2, and a standard notching press, *Fig.* 4, which is found to be most economical for the size of runs. The blanking press is equipped with an automatic coil stock feeder.

The operations required to produce a completely machined lamination are as follows:

1. Set up blanking press
2. Blank and collect in shop box
3. Manually transport box of blanks down roller conveyor to temporary storage
4. Manually transport box of blanks from temporary storage to notching press
5. Set up notching press
6. Manually transport quantity of blanks from box to separator magnet on table beside notching press
7. Manually load one blank into notching press
8. Notch
9. Manually unload blank from notching press and place on checking arbor
10. Repeat Items 1, 2, 3 and 4 until desired production is reached.

The following people are employed to perform the operations outlined above: notching presses—5 operators; blanking press—1 operator; setups—1 operator. The blanking press operator is responsible for transporting blanks from the blanking press to temporary storage and the notching press operators are responsible for transporting blanks from temporary storage to the notching presses.

In proceeding with Step 2 of the analysis process, positive thinking must be exercised. No attempt should be made at this point to solve any intermediate problems necessary to accomplish the automa-

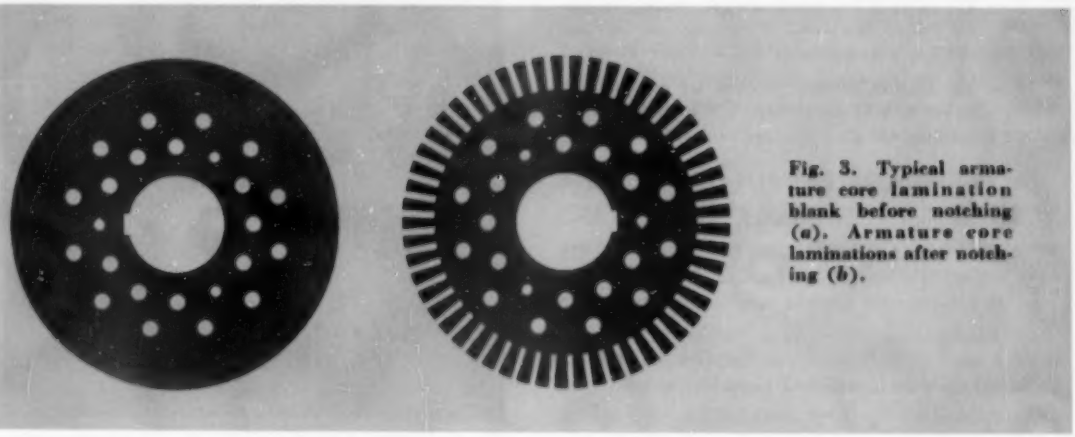


Fig. 3. Typical armature core lamination blank before notching (*a*). Armature core laminations after notching (*b*).

tion objective. This is important; otherwise a false impression may be conceived that an insurmountable intermediate obstacle exists. This could be detrimental to the extent that just what automation might accomplish would never be learned.

Conceivably, two degrees of automation might be applied to this operation. First, a completely automated installation might be set up from the blanking operation through the notching operation. This system would basically consist of the following:

1. Automatic feeder for coil stock at the blanking press
2. Automatic handling and transporting from the blanking press to the notching presses.
3. Automatic loading at the notching presses
4. Automatic unloading and stacking in complete core assemblies at the notching presses.

The primary advantages of this system would be decreased manufacturing cost, a shortened manufacturing cycle and decreased inventory. A diagram of this system is shown in *Fig.* 5. A second conceivable system that might be applied in this operation would be partial automation from blanking through notching. Basically, this system would be as follows:

1. Automatic feeder for coil stock at the blanking press
2. Automatic collecting after blanking
3. Mechanical handling to storage and from storage to the notching presses
4. Automatic loading at the notching presses
5. Automatic unloading and stacking complete core assemblies at the notching presses.

The primary advantages of this system would be decreased manufacturing cost, a shortened manufacturing cycle and flexibility of production. Fundamentally, the difference between this system and the completely automatic system is that there is no automatic handling from the blanking operation to the notching operation. A block diagram of the partially automated system is shown in *Fig.* 6.

Next an analysis must be made of each system to properly evaluate whether either one is feasible and to determine what can be gained from incorporation of each system. Steps 3 and 4 of the analysis procedure are primarily designed to evaluate a completely automated system. Steps 5 and 6 are primarily designed to evaluate a partially automated system. However, these two steps are also necessary in order to arrive at a final analysis of either.

Analysis of the completely automated setup should begin with an investigation of the time balance required between the blanking and notching operations with continuous flow production. The results of this investigation will determine if continuous flow production is feasible.

To begin the time balance investigation, the entire manufacturing cycle is visualized as one completely integrated mechanism in continuous motion. Then suitable mathematical equations are developed that will permit an examination of the time balance in the system under all known conditions of production requirements. In developing these equations, any known automatic device is incorporated that might be applicable to the operations involved.

For instance, in this operation, there is one known device that might be applied in an automated installation. The device is an automatic notching press loader, such as *Fig.* 1. This device will automatically load the press, cycle the machine and unload the press, all in continuous operation.

Development of the mathematical equation requires that basic definitions be given to the terms and symbols used. So, let:

X = Output of one blanking press in laminations per minute

Y = Output of one notching press in laminations per minute

Z = The number of identical notching presses

N = The number of notches required per lamination

S = The speed of a notching press in strokes per minute (Note: One stroke of the press produces one notch in a lamination.)

T = The time in minutes required for an automatic loader to load and unload one lamination in a notching press.

For an absolute time balance to exist between one blanking press and any number of notching presses,

$$X = Z\,Y \qquad (1)$$

where

$$Y = \frac{S}{N + T\,S} \qquad (2)$$

Substituting Y in Equation 1 gives

$$X = Z\left[\frac{S}{N + T\,S}\right] \qquad (3)$$

Equation 3 gives a mathematical relationship showing the conditions necessary for a time balance in the system with any given lamination being produced in a continuous flow setup. Values must now be assigned to the symbols of the equation so that the situation can be studied. The values are arrived at through known information, measurements and estimates.

Fig. 4. Standard notching press used to notch armature core lamination blanks.

The speed of the blanking press in question can be varied from 20 to 60 strokes per minute. Considering single blanking only, X will vary from 20 to 60. The speed of a notching press was checked at 540 strokes per minute. This is approximately the maximum safe operating speed of the present notching presses, so assume S to be 540 constantly. The value of N will vary from 18 to 58.

It is estimated that the average total time required

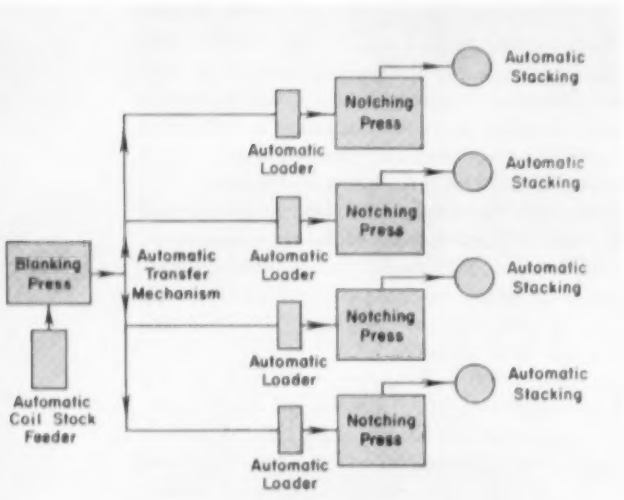
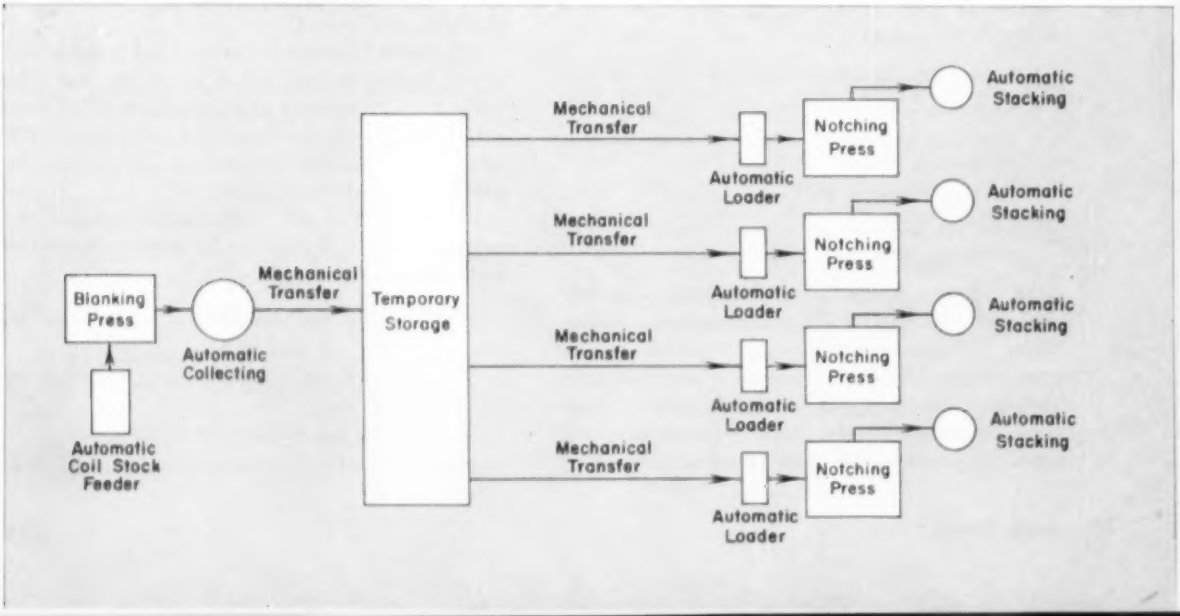


Fig. 5. (right) Block diagram of completely automated arrangement for armature core lamination production.

Fig. 6. (below) Block diagram of partially automated system for armature core lamination production.



to load and unload one lamination at the notching press with an automatic loader will be 0.05 minute. This estimate is based on information received from the manufacturer of a notching press loader, plus addition of a safety factor to account for unknown time delays that might result with variation in lamination diameters. The value of T will be 0.05 and will be a constant.

By substituting in Equation 3, it can be seen that, with a fixed number of notching presses being fed by one blanking press, a variation of the number of notches required per lamination will necessitate a change in speed of the blanking press in order to maintain a time balance in the system. This factor is important in attempting to synchronize continuous production between the blanking and notching operations. The significance of this can be seen readily by the curves plotted in *Fig.* 7. These curves were obtained by substituting values for N and Z and calculating the values of X. With one blanking press feeding two notching presses, synchronization of the system can be obtained only if the notches required per lamination fall between 18 and 28. With one blanking press feeding three notching presses, synchronization of the system can be obtained only if the notches required per lamination fall between 18 and 54; with four notching presses, synchronization of the system can be obtained if the notches required per lamination fall between 18 and 76.

It then follows that at least four notching presses will be required to synchronize the output of the existing blanking press in a continuous production installation for the entire range of notches required per lamination, based on present production requirements. It can also be noted from these curves that with continuous production flow between these operations, maximum available production from the blanking press would have to be sacrificed under all conditions. These curves were analyzed on the basis of single blanking only. The conditions that would prevail with double blanking would aggravate the situation considerably more since the blanking press speed would be only half that which is shown for single blanking.

Steps 3 and 4 of the analysis procedure have now been completed. Actual machine time required to perform the necessary operations with existing machines, Steps 5 and 6, must be determined and compared with total time allowed an operator to complete the operations.

The time allowed an operator to produce a blank ready for notching is 0.0468 minute each for single and 0.0162 minute each for double blanking. This information may be taken from time standards records.

Again, a mathematical relationship can be developed that will show the machine time actually required to produce a blank at different press speeds. This relationship may be expressed as follows:

$$t = \frac{1}{sb} \qquad \text{.....(4)}$$

where

t = Time in minutes required to produce one blank

s = Speed of the press in strokes per minute

b = Number of blanks produced in one stroke of the press.

For single blanking dies:

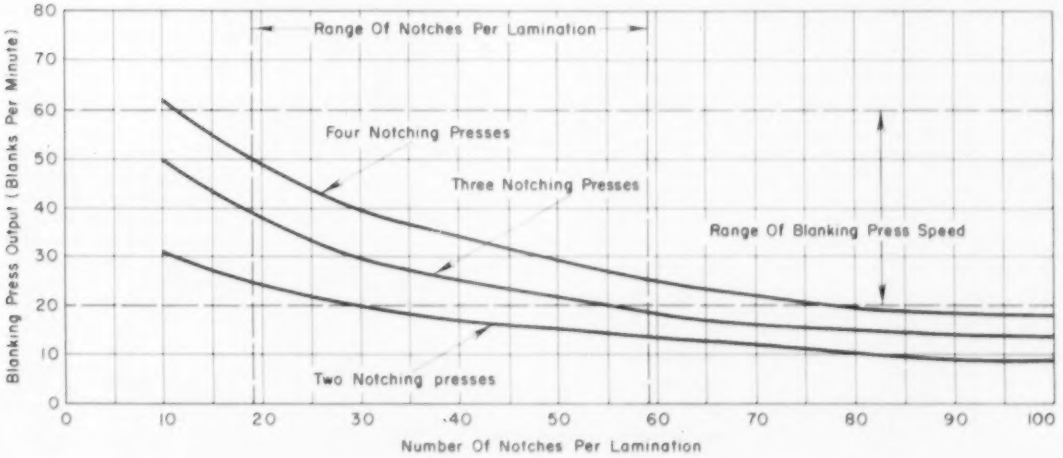
$$t = \frac{1}{s} \qquad \text{.....(5)}$$

And for double blanking dies:

$$t = \frac{1}{2s} \qquad \text{.....(6)}$$

Referring to *Fig.* 8, it can be seen that calcula-

Fig. 7. Graph showing time balance between one blanking press on a number of notching presses.



tions of the value of machine time per blank (t) over the range of press speeds permit curves to be plotted of Equations 5 and 6. Also, the times allowed the blanking press operator are plotted as straight lines.

It will be noted that the time allowed the press operator is somewhat greater than that actually required by the machine to produce a blank. The significance of this factor is that there is a potential time saving available at this operation if a mechanical means of collecting and transporting blanks away from this machine is incorporated.

Moving to the notching operation, the total times allowed a notching press operator to complete the notching operations for laminations requiring different numbers of notches are shown in TABLE 1. Mathematically, the actual machine time required to produce the required notches in one blank is shown by the following relationship, where M is time in minutes required to notch one lamination:

$$M = \frac{N}{S} \quad \ldots\ldots (7)$$

Substituting the known value for S, which is 540 strokes per minute, the equation becomes:

$$M = \frac{N}{540} \quad \ldots\ldots (8)$$

Calculations of the values of M over the range of notches required per lamination result in data which may be plotted, *Fig.* 9. Also, times allowed the notching press operator are plotted as straight lines. Further examination of *Fig.* 9 discloses that the time allowed a notching press operator is somewhat greater than the actual machine time required to produce the necessary number of notches per lamination. It follows then that potentially there is a considerable time saving available at this operation if automatic loaders are installed on the notching presses.

Table 1—Notching Time Allowed per Lamination

Notches per Lamination (number)	Time Allowed Operator (minute)
18 through 36	0.156
37 through 42	0.168
45 through 49	0.186
50 through 58	0.198

Now that an investigation has been made of the feasibility of automating this operation, Steps 7, 8 and 9 of the analysis procedure must be completed in order to determine if automating this operation will be economically sound.

Analysis of the completely automated installation showed that four notching presses will be required to maintain continuous flow production with one blanking press. Investigation discloses that because of certain variables the notching operation cannot be split; therefore, duplicate dies for the notching presses will be required. This means that at least 150 duplicate dies must be procured.

With automatic loaders on the notching presses, one operator can tend as many as five machines. This means that direct labor costs can be substantially reduced. Examination of *Fig.* 9 shows that an average time of 0.127 minute will be required to completely notch one lamination on a notching press equipped with an automatic loader. Based on the present production rate of 70,000 laminations per week, the total average weekly notching production

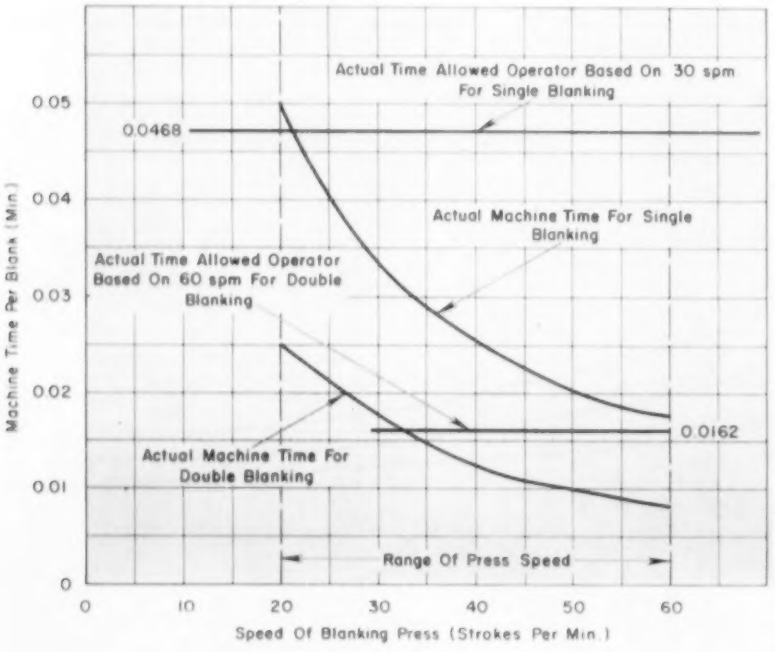


Fig. 8. Graph showing relationship between time allowed blanking press operator and actual machine time for single and double blanking.

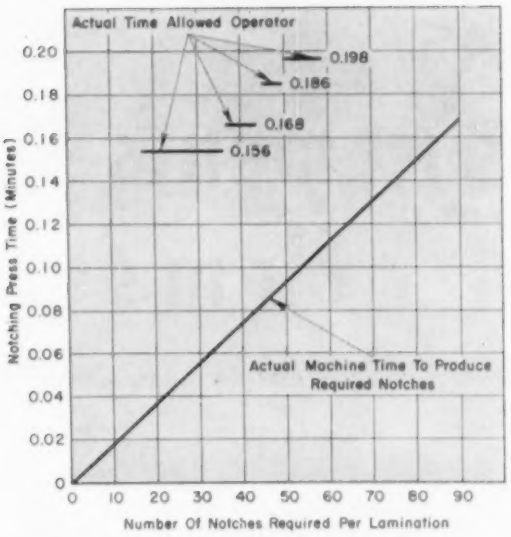


Fig. 9. Graph showing relationship between time allowed notching press operator and actual machine time.

time required will be approximately 148 machine hours. It then follows that four notching presses equipped with automatic loaders will be required to maintain the required rate of production on a one-shift basis.

Examination of the costs and savings reveal that with a completely automated system, a potential saving of $19,247 is available from an expenditure in the neighborhood of $84,800, TABLE 2. Breaking this down further, it is found that the application of an automatic transfer mechanism between blanking and notching would cost $54,500 and result in total savings of $1,611.

In addition, this system would increase the unit cost of producing blanks because production would be sacrificed by the slower operation required of the blanking press to remain in flow synchronization with the notching presses. Application of automatic loading machines at the notching presses would result in total costs of $30,300 and give total savings of $17,636.

Table 2—Savings and Cost Summary of a Completely Automated System

SAVINGS	
Annual labor savings at the blanking press due to mechanical handling (760 hours @ $1.80 per hour)	$ 1,368
Annual overhead savings directly due to labor savings	243
Annual labor savings at the notching press (8320 hours @ $1.80 per hour)	14,976
Annual overhead savings directly due to labor savings	2,660
Total	$19,247
COSTS	
Cost of 150 duplicate notching dies @ $250 each	$37,500
Cost to develop and install automatic transfer mechanism between blanking and notching operations	15,000
Annual additional setup and maintenance costs for transfer mechanism	2,000
Cost of 4 automatic notching press loaders	28,800
Annual additional setup and maintenance costs for automatic loaders	500
Cost of installing automatic loaders and additional tooling	1,000
Total	$84,800

Step 10 of the analysis procedure naturally follows after the investigations are complete. The results of the investigations must be evaluated and a decision must be made.

What factors should be examined in the evaluation? Primarily, feasibility of automation and its economic justification are the determining factors. Product obsolescence and business forecasts are also important. The total costs would be incurred to establish an automatic transfer mechanism between the blanking and notching operations in this application make a completely automated installation a poor investment. Approximately 34 years of production of this nature would be required to break even on the first year cost.

On the other hand, application of automatic loaders at the notching presses presents an entirely different picture. This investment would pay for itself in less than two years. Usually, industrial management would consider this to be a sound investment so, on this basis, a partially automated system is better for this operation. After evaluation, the possible decisions that might be made from the analysis can be classified as short range and long range.

The short range decision might be to install automatic notching press loaders and take advantage of the potential savings immediately available by their application. These loaders will become the nucleus of a completely or partially automated system that might be justifiable in the future by more product standardization.

After the automatic loaders are installed, several long-range developments might be decided on, such as: analysis and development of an automatic device for stacking laminations in core assemblies after notching; analysis and development of a mechanical collecting and transporting means from the blanking press to the notching press; in addition, at some time in the future, when production becomes more stabilized, another investigation might be conducted on the feasibility of a completely automated system.

Advantages of this kind of an approach to mechanization and automation are that the problem is simplified by breaking it down into easily understood elements; a reasonably accurate picture is secured of pros and cons of any proposed improvement; and finally, specific cost data is obtained to present to management. When a completely automatic installation lacks economic justification, as in the example cited, this kind of study will uncover alternatives that may provide gains even greater than anticipated.

exact method for computing

Over-Pin Measurements for Helical Forms

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Fully aware of other formulas and methods for determining pin measurements, the authors believe that these procedures are useful in solving problems and add to the understanding of basic concepts. Because of the importance of this subject, a paper on these procedures will be presented at the forthcoming June meeting of the American Gear Manufacturers Association.

WORM OR SCREW THREAD thickness and gear tooth thickness are conveniently and universally inspected by measurements over pins, *Fig.* 1. Over-pin measurements are ordinarily calculated by use of tables and formulas that give close approximations. For most applications, these methods give satisfactory results. Where greater accuracy is required, the following formulas provide a theoretically exact solution, regardless of tooth form, and show the variables that must be considered when determining the exact pin diameter and over-pin measurement.

These formulas are based upon a pin whose size is so chosen that it contacts a particular point on the profile, usually the pitch point. With such a condition, the solution is independent of the tooth or thread profile. All worms, screws and helical gears having the same pitch diameter, lead, axial pressure angle and space width can use pins of the same diameter and will have identical over-pin measurements.

When numerical values for the foregoing variables are known, the following method can be used to determine the diameter of the required pins and the over-pin measurement. Proof of these formulas will be presented as an appendix.

It is first necessary to determine the axial pressure angle, and its tangent, for the point of contact between the measuring pin and the helix. Any value of R can be used but it is generally most convenient to let R be the pitch radius of the form because the value of J at the pitch radius is usually referred to. Since the axial pressure angle may vary for different radii, the values of J and R must be compatible. The axial pressure angle is usually known for screw threads but must be calculated for worms and helical gears.

With A, B, R and J known, K is found from the transcendental equation following:

$$\tan K = \frac{B(A - BK)}{R[R + J(A - BK)]} \quad \ldots\ldots\ldots\ldots (1)$$

Although this is an exact relationship, it cannot be solved directly. Instead, an approximate value of K is calculated and substituted in Equation 1. If Equation 1 becomes an identity, the value of K is exact; if not, a new value for K must be tried. This procedure is repeated until the lack of identity is in the seventh decimal place. Such trial-and-error methods appear unwieldy but can quickly give accurate results, especially with calculators.

*Senior members ASTE Rockford chapter.

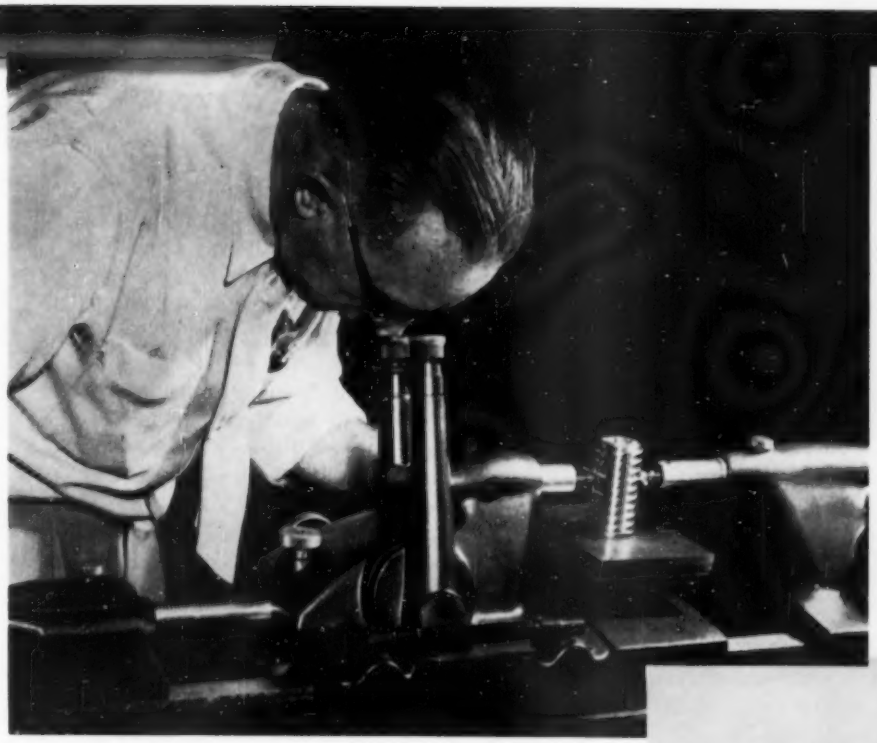
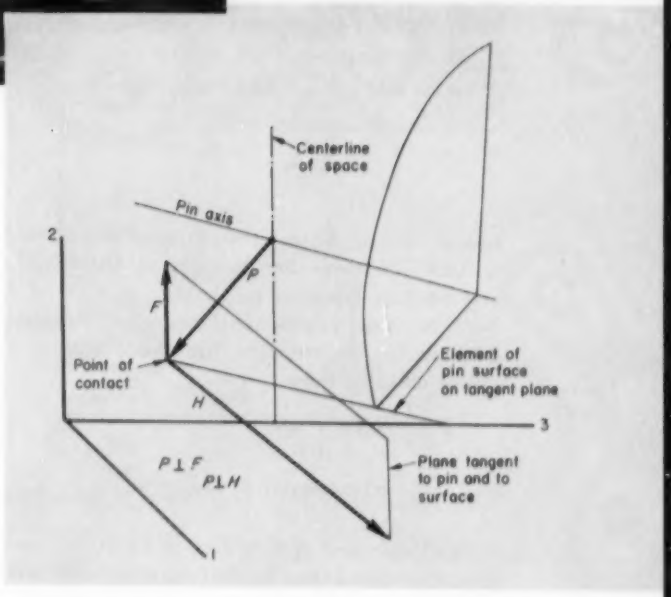


Fig. 1. (left) Worm form thickness can be conveniently measured over pins but calculation of the desired measurement may require extreme accuracy.

Fig. 2. (below) Diagram of a point of contact between a pin and the helix being measured.



The first approximate value of K is obtained from:

$$\tan K = \frac{b}{c} + \frac{\left(\frac{b}{c}\right)^3}{c} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where $b = \dfrac{A}{RJ}$ and $c = \dfrac{B^2 + R^2 + ARJ}{BRJ}$

When a good value of K has been found, the pin diameter can be calculated from:

$$d = \frac{2(A - BK)}{R}\sqrt{R^2(1 + J^2) + B^2} \quad \ldots\ldots (3)$$

The radial measurement over one pin is then found by:

$$R_m = \frac{B(A - BK)}{R \sin K} + \frac{d}{2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Actual procedure for this method can be most easily followed through use of an example. Consider a six-thread worm for which characteristic values are found to be:

$A = 0.1666667$ $\qquad$ $B = 0.6366197$

$R = 1.2878000$ $\qquad$ $J = -0.3906836$

An approximate value for K is found by calculating b and c:

$$b = \frac{0.1666667}{(1.2878000)(0.3906836)} = 0.3312647$$

$$c = 6.7049119$$

and substituting these values in Equation 2:

$$\tan K = 0.0494062 + 0.0003640 = 0.0497702$$

The approximate value for K is therefore 0.0497291 radians. This value is then used in the right side of Equation 1:

$$\tan K = \frac{(0.6366197)(0.1350082)}{1.7263545} = 0.0497863$$

Since this new value of tan K differs from that found with Equation 2, it is used for the second trial. The corresponding $K = 0.0497451$ radians. This value of K is used in the right side of Equation 1:

$$\tan K = \frac{(0.6366197)(0.1349980)}{1.7263493} = 0.0497827$$

For the first trial value, the actual tangent (0.0497702) is 0.0000161 less than the tangent (0.0497863) calculated by Equation 1. For the

Nomenclature

A = one-half the axial distance between two adjacent helices

B = one-half the lead divided by pi

d = pin diameter

e = a small error

F = vector, tangent to form in a radial plane

H = vector, tangent to helix at point of contact

J = tangent of the axial pressure angle on the helix surface R units from the axis

K = angle, in radians, in transverse plane between axial plane of worm and radial plane containing point of contact

P = vector, radius from pin center to contact point

R = radius of helix

R_m = radial measurement over one pin

R_w = distance from axis to center of pin

ϕ_R = axial pressure angle R units from the axis

second value of K, the actual tangent (0.0497863) is 0.0000036 more than the tangent (0.0497827) calculated by Equation 1. The desired value of K lies between the first two trial values and, dropping decimals for the errors, a third trial value of K can be obtained from:

$$K_3 = \frac{e_1(K_2) + e_2(K_1)}{e_1 + e_2}$$

$$= \frac{161(0.0497451) + 36(0.0497291)}{161 + 36} = 0.0497421$$

This third value of K is used in Equation 1 and gives a computed value for the tangent of 0.0497834. Since the actual tangent of an angle of 0.0497421 radians is 0.0497832, the error has been reduced to two parts in the seventh place.

The pin diameter can now be calculated with Equation 3, using a value of 0.0497421 for K:

$$d = \frac{(0.2699998)(1.5221188)}{1.2878000} = 0.3191270$$

To obtain the radial measurement over one pin, numerical values are substituted in Equation 4:

$$R_m = \frac{(0.6366197)(0.1349999)}{(1.2878000)(0.0497216)} + \frac{0.3191270}{2} = 1.5017715$$

Although the worm of this example has an even number of starts, three pins can be used if the two pins that are on the same side are positioned one pitch apart. The over-pin measurement is then twice the radial measurement over one pin. This six-start worm with its 4-inch lead has a 2.5756-inch pitch diameter and an axial pressure angle whose tangent is 0.3906836. Measurement over pins should be 3.0035 inches when 0.3191-inch pins are used.

For this example, the axial pressure angle was calculated by assuming the use of a 3.250-inch diameter grinding wheel having a straight-sided, 40-deg included angle form, and which was set at an angle equal to the lead angle of the worm. Backlash was assumed to be absent. To include backlash in the calculations, it is only necessary to increase the value for A by half the amount of the assumed backlash.

Although these formulas may be somewhat complicated for everyday use, they do emphasize the problems involved in the over-pin measurement of worms of unknown profile. (Another approach, including exact and approximate formulas, has been developed by Dr. Werner F. Vogel, Wayne State University, Detroit, and published in The Van Keuren Co. Catalog No. 36.)

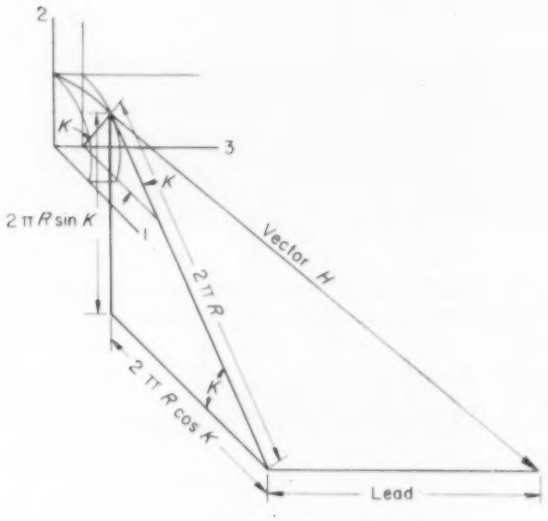
Desk calculators, or computers depending on the accuracy desired, can be used effectively in working through these calculations. These methods are valid for over-pin measurements when the best pin is used, regardless of helical form, but problems with available pin sizes must be solved differently for each form. In a forthcoming issue, the solution of available-pin problems for involute helicoids will be discussed.

Appendix

Proof of this method is achieved by considering one contact point in detail. At such a point, three vectors, *Fig.* 2, can be constructed to conform to the definitions given in the Nomenclature. The third vector, representing a pin radius to the point of contact must be perpendicular to both of the other vectors.

By writing equations for the two conditions of perpendicularity and eliminating the value of the distance from the axis to the center of the pin, a single equation with one unknown is obtained. This unknown is an angle describing the position of the contact point. By solving for this angle and substituting its value into either of the two expressions for perpendicularity, it is possible to determine the distance between the axis and the center of the pin. The over-pin meaurement can be calculated easily when this distance is known.

This approach is used because of its geometric simplicity and independence of form. Values of R, B and J are assumed to be the same for similar points on all portions of helices for a given thread, worm or gear. The axial pressure angle is defined by intersecting the helical surface with an axial plane. The curve of intersection has a tangent at a point R units from the axis. The angle between



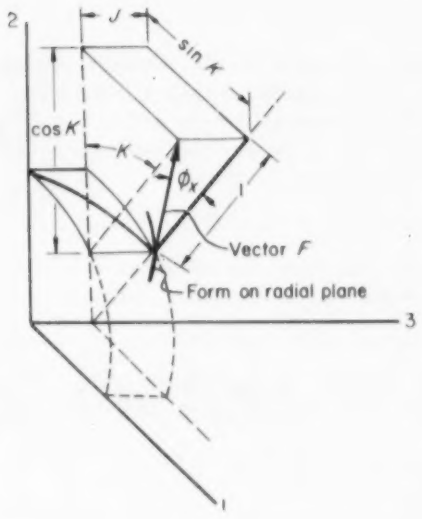
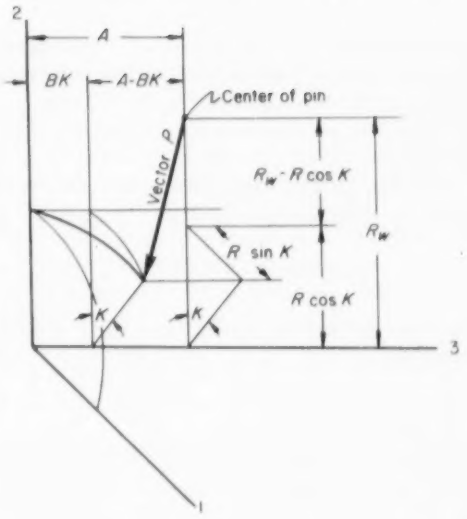


Fig. 3. (above) Relationships between the vector that is tangent to the helix at the point of contact, and the locating angle.

Fig. 4. (upper right) Relationships between the vector in a radial plane that is tangent to the form, and the axial pressure angle.

Fig. 5. (right) Drawing of the pin radius that is a vector to the point of contact.



this tangent and a radius is the axial pressure angle.

To derive Equation 1, the direction components of the three vectors are written. In *Fig.* 3, it can be seen that unwrapping the helix from a contact point creates a right triangle whose hypotenuse is the vector H, one side of which is equal to the lead and the third side of which is equal to the circumference, $2\pi R$. In a second triangle, $2\pi R$ is the hypotenuse and K is one of the acute angles. Vertical side of this second triangle is $2\pi R \sin K$ and its horizontal side is $2\pi R \cos K$.

Numbering the axes as shown, the direction components for H are:

$$2\pi R \cos K, -2\pi R \sin K \text{ and the lead}$$

By dividing by 2π and noting the definition of B, the components are:

$$H_1 = R \cos K, H_2 = -R \sin K \text{ and } H_3 = B$$

To derive the direction components of vector F, a unit distance is described along a radius extended through the point of contact, *Fig.* 4. Direction components can be read directly from the sketch:

$$F_1 = \sin K, F_2 = \cos K \text{ and } F_3 = -J$$

To find the direction components of the pin radius to the contact point, it should be noted that the center of the pin is on the centerline of the screw space, *Figs.* 5 and 6. Axial distance BK is derived by noting that K is expressed in radians and that B is the ratio of the lead to 2π. Direction components of vector P are:

$$P_1 = R \sin K, P_2 = -(R_w - R \cos K) \text{ and } P_3 = -(A - BK)$$

Vectors H and P must be perpendicular because H lies on the tangent plane to the pin surface and P is normal to the pin surface. Also, H and P meet at the point of contact. Whenever two vectors are perpendicular, the sum of the products of their respective direction components must be zero:

$$H_1P_1 + H_2P_2 + H_3P_3 = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Putting values for the direction components into Equation 5, expanding, simplifying and transposing, results in:

$$R R_w \sin K = B(A - BK) \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Vectors F and P are also perpendicular because F lies on a plane that is tangent to the pin surface and P is normal to the pin surface. The sum of the products of the direction components of these vectors must also be zero:

$$F_1P_1 + F_2P_2 + F_3P_3 = 0 \quad \text{.....(7)}$$

Substituting values for the direction components into Equation 7 and reducing results in:

$$R_w \cos K = R + J(A - BK) \quad \text{.....(8)}$$

By dividing corresponding members of Equations 6 and 8, the R_W factor cancels out to leave:

$$\frac{R \sin K}{\cos K} = \frac{B(A - BK)}{R + J(A - BK)}$$

which can be written:

$$\tan K = \frac{B(A - BK)}{R[R + J(A - BK)]} \quad \text{.....(1)}$$

This equation is the key formula of this method. Its exact solution has not been obtained in explicit form, but it can be solved to any desired degree of accuracy by sufficient trial, as indicated in the example.

In order to derive Equation 2, tan K is substituted for K in the right-hand side of Equation 1:

$$\tan K = \frac{B(A - B \tan K)}{R[R + J(A - B \tan K)]}$$

This can be written in the form of a quadratic equation in tan K:

$$\tan^2 K - c \tan K + b = 0 \quad \text{.....(9)}$$

An approximate solution of Equation 9 can be obtained by neglecting the squared term because the value of tan K is small. This omission results in:

$$\tan K = \frac{b}{c}$$

This value for tan K is too small because of the neglected term so a small error is added:

$$\tan K = \frac{b}{c} + e \quad \text{.....(10)}$$

Substituting Equation 10 into Equation 9 gives:

$$\frac{b^2}{c} + 2e\left(\frac{b}{c}\right) + e^2 - c\left(\frac{b}{c}\right) - ec + b = 0 \quad \text{.....(11)}$$

Neglecting the e^2 term, this equation can be solved for e:

$$e = \frac{\left(\frac{b}{c}\right)^2}{c - 2\left(\frac{b}{c}\right)} \quad \text{.....(12)}$$

An approximation for tan K is thus given by:

$$\tan K = \frac{b}{c} + \frac{\left(\frac{b}{c}\right)^2}{c - 2\left(\frac{b}{c}\right)} \quad \text{.....(13)}$$

Since the ratio of b to c will be small compared to c, the negative term in the denominator of the second fraction can be neglected. This results in Equation 2.

Many approximation equations could be used. Equation 13 could be used or Equation 9 could be solved as a quadratic. Equation 2 is preferable, however, because of its simplicity and reasonable accuracy. Whatever approximation equation is used, the result has to be checked in Equation 1 until it is sufficiently accurate for use in Equations 3 and 4.

The pin diameter is determined from Equation 3, which is derived from *Fig.* 5. This derivation is based on the fact that d is twice the length of vector P. Vector P is the diagonal of a rectangular prism whose sides are $(R_W - R \cos K)$, $R \sin K$ and A-BK, or:

$$d = 2\sqrt{(R_w - R \cos K)^2 + R^2 \sin^2 K + (A - BK)^2} \quad \text{.....(14)}$$

With values for direction components substituted in Equation 7 and through use of Equation 1 and trigonometric identities, this can be written as Equation 3.

The value of R_W can be found from either Equation 6 or Equation 8. The radial measurement over one pin is equal to R_W plus half of the pin diameter.

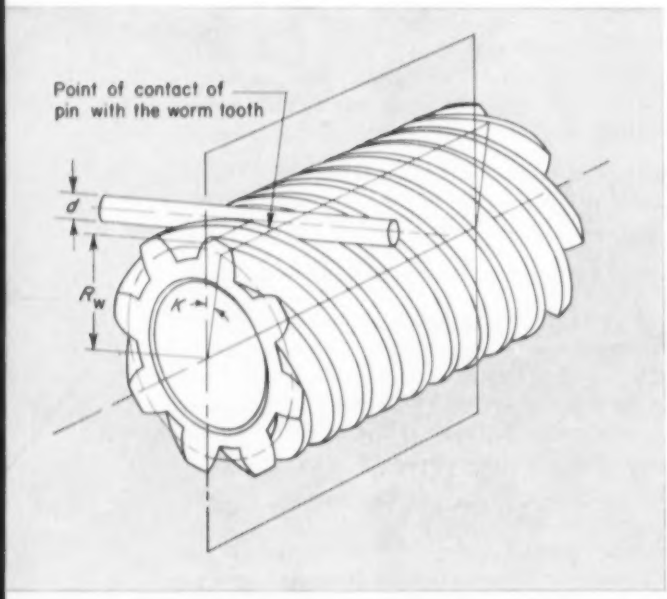


Fig. 6. Diagram showing the relationship between the distance from the worm axis to the center of the pin, and the locating angle.

brazing filler metals

BRAZING FILLER metals, simply speaking, are metals that are added when making a braze. They have melting points below those of the base metals being joined and have properties which enable them to penetrate between closely-fitted surfaces by capillary action.

Brazing filler materials are grouped into seven major classifications, according to chemical composition. Each classification is identified by the prefix B, for brazing filler metal, followed by the chemical symbols for the main constituent elements. Within each classification, the percentages of constituent elements vary, so filler metals are further identified by an arabic numeral suffix. A metal identified as BAlSi-1, for instance, is a brazing filler metal containing large percentages of aluminum and silicon, and is one of a series of aluminum-silicon compositions. Brazing filler metals which are also suitable for welding rod are identified by the prefix RB, followed by chemical symbols for the main constituents and a capital letter suffix.

In addition to the BAlSi metals, other brazing filler metal classifications include copper-phosphorus (BCuP), silver (BAg), copper-gold (BCuAu), copper (BCu), copper-zinc (RBCuZn), magnesium (BMg), and two heat-resisting materials, BNiCr and BAgMn.

Brazing Temperatures: There is a wide variation between the brazing temperature ranges of filler metals within and between the various classifications. These temperature ranges are shown in TABLE 1. It will be noted that the brazing temperature ranges begin below the liquidus point. It is a basic principle in brazing that the lowest temperature within the recommended range be used, consistent with the joint clearance and the time needed to complete the braze. These factors in turn depend on the composition of the materials being joined, the brazing process employed and the joint design.

Extracted from Tentative Specification for Brazing Filler Metal (ASTM B 260-56T; AWS A 5.8-56T) issued by the American Welding Society and the American Society for Testing Materials.

Prebraze Cleaning: Irrespective of the type of brazing material or brazing process used, prebraze cleaning of the base metal is essential. The surface should be free of grease, oxides, scale and dirt of any kind. Grease or oil can be removed by a reliable degreasing solution such as trichloroethylene or trisodium phosphate. Oxides can be removed chemically or with a fine emery cloth after degreasing. Steel grit blasting, shotblasting or grinding can be used to remove surface scale.

Brazing Filler Metal Characteristics: Brazing filler metals are available in a variety of standard forms and sizes, making it possible to select the best form for each type of brazing process and application. Standard forms and sizes for each classification of brazing material are shown in TABLE 2.

Selection of brazing filler metals for specific applications is dependent on the composition of the base metal, the clearances required and the brazing process used. Since some filler metals are more corrosion-resistant than others, this, too, can be a factor in filler metal selection. An additional factor, in some cases, is the color of the finished braze.

ALUMINUM-SILICON METALS: Filler metals of the BAlSi classifications are used for joining aluminum and aluminum alloys, specifically 1100, 3003, 3004, 5250, 6951, 6053, 6061, 6062 and 6063, and A612 and C612 cast alloys. The BAlSi-1, -2 and -3 filler

metals are most suitable for furnace and dip brazing; BAlSi-4 metal is best suited for torch brazing but can be used with the furnace and dip processes. The aluminum-silicon filler metals are also used to a limited extent with other brazing processes. Generally, metals in the BAlSi classification are utilized in making lap type, rather than butt type joints. Clearances of 0.006 to 0.010 inch are common for laps less than ¼ inch long; clearances up to 0.025 inch are used for longer laps. Fluxing is essential. Fluxing residue must be removed immediately after brazing. Immersion in boiling water will generally remove the residue; if this is not adequate the parts can be immersed in a concentrated nitric acid solution and then rinsed thoroughly.

BAlSi-2 filler metal is available only as a coating on 3S and J51S aluminum alloy core sheet, coated on one or both sides. The other aluminum-silicon filler metals are general-purpose metals. BAlSi-4 metal has relatively high resistance to corrosion.

COPPER-PHOSPHOROUS METALS: The BCuP metals are used primarily for joining copper and copper alloys, with some limited use on silver, tungsten and molybdenum. Because of their phosphorous content, these metals should not be used on ferrous metals. For the same reason, they should not be used on alloys containing more than 10 percent nickel. They are suitable for all brazing processes. Lap and butt joints are generally used.

Metals in this group have self-fluxing properties when used on copper; however, a flux is recommended when joining other metals, including copper alloys. Joints made with the BCuP metals on copper have excellent electrical and thermal conductivity. Corrosion resistance of the braze is generally equal to or better than that of the base metal being joined. These metals are not, however, recommended for use in sulfurous atmospheres above room temperatures, since corrosion may result.

The constituents of BCuP metals have a tendency to separate if heated slowly. The constituent with the lowest melting point melts and flows first, leaving behind a "skull" of the higher-melting-point constituent. This occurrence, called liquation, is undesirable since the unmelted skull does not contribute significantly to the strength of the brazed joint. It is important, therefore, to heat as rapidly as possible, especially if the filler metal is preplaced. Color after brazing is light gray. Immersion in 10 percent sulfuric acid will restore the copper color.

BCuP-1 brazing filler metal is used primarily for preplacing in the joint and is suited particularly for resistance brazing and some furnace brazing applications. This metal is somewhat more ductile than the other BCuP metals, owing to a lower phosphorus content. It is also less fluid at brazing temperature. Joint clearances should be from 0.002 to 0.005 inch.

BCuP-2 metal is extremely fluid at brazing temperatures and will penetrate joints with small clearances. Best results are obtained with clearances of 0.001 to 0.003 inch. BCuP-3 metal is also extremely fluid at brazing temperatures. Joint clearances of 0.002 to 0.005 inch are recommended. Joint clearances for BCuP-4 metal are 0.001 to

Table 1—Brazing Temperature Ranges for Standard Filler Metals

AWS-ASTM Classification	Solidus* (deg F)	Liquidus* (deg F)	Brazing Temp. Range (deg F)
Aluminum-Silicon:			
BAlSi-1	1070	1165	1150-1185
BAlSi-2	1070	1135	1120-1140
BAlSi-3	970	1085	1060-1185
BAlSi-4	1070	1080	1090-1185
Copper-Phosphorus:			
BCuP-1	1305	1650	1450-1700
BCuP-2	1305	1485	1350-1550
BCuP-3	1190	1480	1300-1550
BCuP-4	1190	1330	1300-1500
BCuP-5	1185	1500	1300-1500
Silver:			
BAg-1	1125	1145	1145-1400
BAg-1a	1160	1175	1175-1400
BAg-2	1125	1295	1295-1550
BAg-3	1170	1270	1270-1500
BAg-4	1240	1435	1435-1650
BAg-5	1250	1370	1370-1550
BAg-6	1270	1425	1425-1600
BAg-7	1145	1205	1205-1400
BAg-8	1435	1435	1435-1650
BAg-9	1280	1325	1325-1550
BAg-10	1335	1390	1390-1600
BAg-11	1365	1450	1450-1650
Copper-Gold:			
BCuAu-1	1755	1815	1815-2000
BCuAu-2	1620	1630	1630-1850
Copper and Copper-Zinc:			
BCu	1980	1980	2000-2100
RBCuZn-A	1630	1650	1670-1750
RBCuZn-B	1690	1715	1720-1800
Magnesium:			
BMg	770	1110	1120-1160
Heat-Resistant:			
BNiCr	1850	1950	2000-2150
BAgMn	1760	1780	1780-2100

*Solidus and liquidus shown are for the nominal composition in each classification.

0.003 inch. BCuP-5 filler metal is suited for use where close fits cannot be held. Recommended joint clearances are from 0.003 to 0.005 inch.

SILVER FILLER METALS: Metals of the BAg classification are used for joining all ferrous and nonferrous metals except aluminum, magnesium and some other metals melting below 1500 F. These metals are generally rapid-melting and free-flowing and can be used with all brazing processes. They are available in a number of convenient forms for preplacing in a joint to be brazed. Lap type joints are recommended but butt type joints may be used. For proper capillary attraction, clearances should be between 0.002 and 0.005 inch. Unless brazing is done in a vacuum or inert atmosphere, flux is required.

BAg-1 and -1a filler metals are free-flowing and have other qualities which make them good for general-purpose work. Their melting ranges are narrow. The color after brazing is light yellow. BAg-2 metal, like the BAg-1 metals, is free-flowing and is a general-purpose metal. It also has a light yellow color after brazing. It has a broad melting range, which is helpful where clearances are not uniform, but unless heating is rapid, liquation may occur.

BAg-3 filler metal is used for joining stainless steels to produce corrosion-resisting joints. It is used also for joining carbide tool tips to tool shanks, since it wets the carbide as well as the steel shank. This metal has a wide melting range and is not as free-flowing as BAg-1 and BAg-2; thus it is a good metal for bridging gaps or forming fillets. The color after brazing is a whitish yellow. BAg-4 filler metal, which is used extensively for carbide tip brazing, is freer-flowing than BAg-3 and has a light yellow color after brazing.

BAg-5 and BAg-6 metals are primarily utilized for brazing electrical products, and for products used in the dairy and food industries, where alloys containing cadmium may be prohibited. BAg-6 has a wide melting range. Since it is not as free-flowing as BAg-1 and BAg-2, it is useful for bridging gaps and forming fillets.

BAg-7 is a general-purpose filler metal which melts at low temperatures. It is used particularly for furnace brazing. After brazing, it has a whitish color which blends with the colors of stainless steels. Like BAg-5 and BAg-6 this metal is widely

Table 2—Standard Forms and Sizes of Brazing Metals

AWS-ASTM Classification	Standard Form	Size (inch)
BAlSi-1	wire in coils	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{5}{8}$
	rod, 36-in. lengths	round, $\frac{5}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{5}{8}$
BAlSi-2*	sheet	0.010, 0.020
BAlSi-3	wire in coils	round, $\frac{1}{16}$, $\frac{5}{32}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{5}{8}$
	rod, 36-in. lengths	round, $\frac{1}{16}$, $\frac{5}{32}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{5}{8}$
	sheet	0.010, 0.020
BAlSi-4	wire in coils	round, $\frac{1}{16}$, $\frac{5}{32}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{5}{8}$
	rod, 36-in. lengths	round, $\frac{1}{16}$, $\frac{5}{32}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{5}{8}$
	sheet	0.010, 0.020
BCuP-1	strip	0.005, 0.010, 0.015 by $1\frac{1}{2}$
BCuP-2	wire in coils	round, $\frac{1}{64}$, $\frac{1}{32}$, $\frac{1}{16}$
	round rod	$\frac{1}{32}$, $\frac{3}{64}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, by 18, or 36
	square rod	$\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ by 36
	powder	100, 325 mesh
BCuP-3	wire in coils	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$
	round rod	$\frac{1}{32}$, $\frac{3}{64}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ by 18, 20, or 36
	square rod	$\frac{3}{64}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ by 36
	powder	20, 100, 200, 325 mesh
	strip	0.005, 0.010, 0.015 by 1
BCuP-4	wire in coils	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$
	round rod	$\frac{1}{32}$, $\frac{3}{64}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ by 18, 20, or 36
	square rod	$\frac{3}{64}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ by 36
	powder	20, 100, 200, 325 mesh
	strip	0.003, 0.005, 0.010, 0.025, and by steps of $\frac{1}{4}$ to 6
BCuP-5	wire in coils	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$
	round or square rod	$\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ by 36
	rectangular rod	0.050 by $\frac{1}{16}$ or $\frac{3}{32}$ by 20, $\frac{1}{16}$ by $\frac{1}{2}$ or $\frac{3}{32}$ by 20
	powder	20, 100, 200, 325 mesh
BAg: all classifications	strip	0.003, 0.005, 0.010, 0.020, and by steps of $\frac{1}{4}$ to 6
	wire in coils	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$
	powder	20, 100, 200, 325 mesh
BCuAu-1 and BCuAu-2	strip	to order
	wire in coils	to order
BCu, RBCuZn-A, RBCuZn-D	strip	no standard sizes
	rod	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$ by 18 or 36
	wire in coils	no standard sizes
	powder	40, 80, 120, 200 and 325 mesh
BMg	wire in coils	round, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$
	rod, 36-in. lengths	round, $\frac{1}{16}$, $\frac{5}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$
BNiCr	wire in coils	round, 0.020, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{1}{8}$
	rod	round, $\frac{1}{16}$ by 10
	strip	0.015 by 0.750, 0.020 by 0.300
	powder	325 mesh
BAgMn	strip	0.003, 0.005, 0.010, 0.020 and by steps of $\frac{1}{4}$ to 6
	wire in coils	round, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$
	powder	20, 100, 200, 325 mesh

*Coated on one or both sides; coating varies from 5 to 10 percent of the thickness of the base-metal sheet; several aluminum-alloy base metals are available.

used in the manufacture of dairy and food containers and processing equipment.

BAg-8 filler metal is used primarily in the assembly of electronic and vacuum tubes. It is generally free-flowing; however, it does not flow well on ferrous metals. The color after brazing is white.

The remaining BAg metals, BAg-9, -10 and -11, are commonly used for joining sterling silver. These three metals have different brazing temperatures and so can be used for step brazing of consecutive joints. They have a whitish color after brazing.

Copper-Gold Metals: The BCuAu metals have low vapor pressures, making them suitable for joining parts in electron tube assemblies, where gaseous inclusions are undesirable. In electron tube applications, these metals are usually applied by induction, furnace or resistance brazing in a reducing atmosphere or vacuum, with no flux. For other applications a borax-boric-acid flux is used. The two filler metals in this classification have different melting points, allowing step brazing to be accomplished.

Copper and Copper-Zinc Metals: The BCu and RBCuZn metals are suitable for joining both ferrous and nonferrous metals by various brazing processes. Lap and butt type joints are commonly used. BCu metal is primarily utilized for brazing ferrous metals, nickel and copper-nickel alloys. It is free-flowing and is much used for furnace brazing with hydrogen or dissociated ammonia atmospheres. A flux may be required when brazing base metals containing constituents such as chromium, manganese, silicon, titanium, vanadium, aluminum and zinc, all of which have difficult-to-reduce oxides.

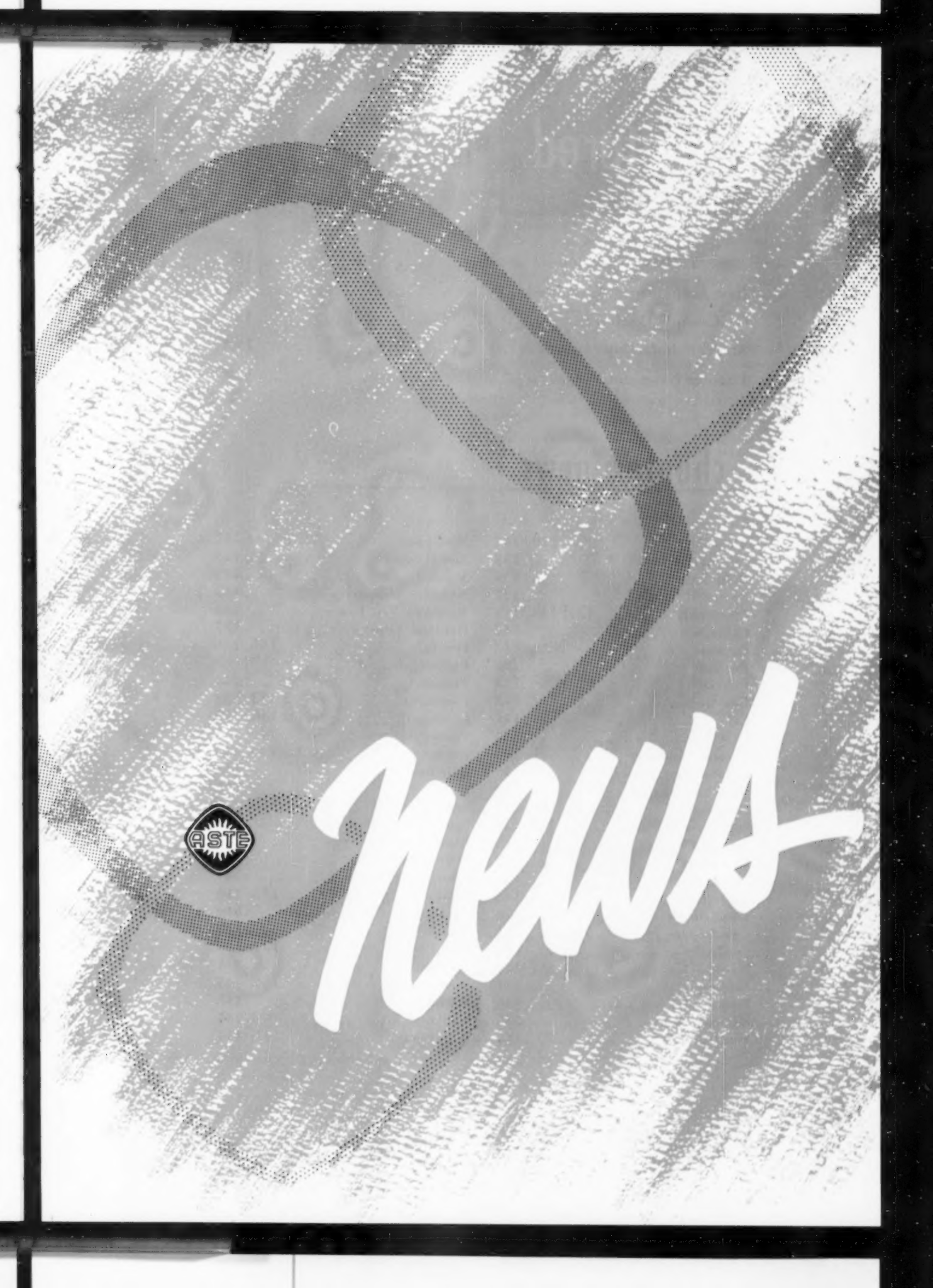
Overheating must be guarded against when brazing with the RBCuZn filler metals, since voids may be formed in the joint by entrapped zinc vapors. Corrosion resistance of these filler metals is generally inadequate for joining copper, silicon-bronze, copper-nickel or stainless steel base metals.

RBCuZn-A metals are suitable for brazing stainless and other steels, copper, copper alloys, nickel, and nickel alloys with the torch, furnace or induction processes. Borax-boric-acid fluxes are used. Joint clearances range from 0.002 to 0.005 inch. RBCuZn-D filler metal, also called white brass and formerly called nickel silver, is utilized to join steels, nickel and nickel alloys, and is adaptable to all brazing processes.

Magnesium Filler Metals: BMg filler metal is used with the torch, furnace and dip brazing processes for joining M-1 magnesium base metal. Heating must be closely controlled to prevent melting of the base metal. Lap type joints are most common. Clearances from 0.004 to 0.010 inch are best for most applications. A flux is required and corrosion resistance is good if the flux is removed after brazing. For furnace brazing, this filler metal is supplied with a small amount of added berylium which prevents possible ignition. For other processes, this addition is not required.

Heat-Resistant Metals: The heat-resistant classifications include the BNiCr and BAgMn classifications. BNiCr filler metal is used chiefly for joining stainless steels and high-nickel alloys intended for high-temperature applications such as jet engine components; however, it can also be used for joining carbon and low-alloy steels. It retains its heat-resistant properties at temperatures up to 2000 F and has excellent corrosion resistance. Primarily, brazing with this metal is done in controlled dry hydrogen atmosphere furnaces, in which case no flux is required. Flux is required, however, when brazing is accomplished in other atmospheres.

BAgMn filler metal is used principally to join stainless steel and high-nickel alloys. It does not have the high-temperature strength of the BNiCr but has good strength in the 500 to 900 F range. Furnace brazing with a reducing atmosphere is most commonly employed with this filler metal. When other brazing processes are used, a flux is required.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Your Society in action

Managing and directing the affairs of our rapidly expanding Society is a challenging job, accomplished through the combined efforts of officers and directors, national committees, and headquarters staff, all working toward the same goals, but with different responsibilities.

Most of our national committees have one of the four national vice presidents serving as an ex officio member, to act as liaison between the committee and the officer group. Each vice president works with committees having related functions, and thus is able to guide their activities in similar directions with a minimum of duplicated effort.

The first vice president, for example, is in charge of the Membership, Public Relations, and Program Committees, which are all working toward different aspects of Society growth—in numbers, prestige and recognition, and quality of programming. The second vice president oversees the committees concerned with publications: Standards, with Data Sheets; Editorial, with THE TOOL ENGINEER; and Technical publications, with the various handbooks.

Education and Professional Engineering Committees, both concerned with the professional development of tool engineers through formal education programs, are within the third vice president's domain, while the fourth vice president coordinates the Constitution and Bylaws Committee with any special committees named by the president during his term.

Staff administrators, working full time at national headquarters, carry out the day-to-day administration of the policies and services proposed by the national committees. In charge of these headquarters operations is the executive secretary, Harry E. Conrad, aided by the assistant executive secretary, Allan Ray Putnam.

Recent changes in the duties of several staff administrators were announced recently. George Hargreaves, who until now has been staff administrator for the Professional Engineering and Standards Committees, is relinquishing these duties to devote full time to the editing of Data Sheets. He will however, continue as Standards administrator until such time as a new man is appointed for this responsibility.

Anthony Downey, in addition to his present position of membership department supervisor, will assume the duties of the Professional Engineering administrator. Mr. Downey also will replace Richard Bacik as staff administrator for the Education Committee, allowing Mr. Bacik to handle the constantly expanding Program Committee activities.

NEW COMMITTEES ANNOUNCED

National committee chairmen newly appointed by the president at the 25th annual meeting have been busy choosing men to serve on their committees and preparing agendas for their first meetings. The men serving on these national committees contribute a valuable service in furthering the aims of the Society. Completion of this partial listing of the committees named to date will appear in the following issue.

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Charles F. Bolden ..... Atlanta
Francis E. Bowers ..... Louis Joliet
George H. Churchill ..... Hamilton
Victor J. Fitting ..... Syracuse
Henry E. Kuryla ..... Hartford
Richard A. Miller ..... Dayton
L. D. Pomerantz ..... Long Beach
L. Dean Roulund ..... Golden Gate
F. Paul Simpson ..... North Texas
Edward H. Wheeler ..... Philadelphia

Ex Officio
George A. Goodwin ..... Vice President

Program Director
Leslie S. Fletcher ..... Headquarters

Staff Administrator
Richard J. Bacik ..... Headquarters

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Chairman
Fred Kampmeier ..... Rockford

Vice Chairman
Verne Loeppert ..... Chicago

Committeemen
Glenn Dilling ..... St. Louis
Duane H. Brighton ..... Peoria
John X. Ryneska ..... Nat. Treas.

Staff Administrator
Charles H. Prince ..... Headquarters

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Donald E. Zierk ..... Fox River Valley

Vice Chairman
Harold D. Sullivan ..... Twin Cities

Committeemen
David Gustafson ..... Golden Gate
Harold W. Hagle ..... Erie
John Hatter ..... Long Island
Leo P. Tarasov ..... Worcester

Ex Officio
Wayne Ewing ..... Vice President

Staff Liaison
John W. Greve, Editor ..... The Tool Engineer

College-Industry Conference

at State University of Iowa

Acclaimed the "best yet," the third college-industry conference was again held at the State University of Iowa. Sponsors of the conference included Cedar Rapids chapter and the department of mechanical engineering of the university in co-operation with other technical and professional engineering societies of Iowa.

Following a welcoming address by Allin Dakin, administrative dean of the university, conferees broke up into two groups, depending upon which of the two concurrent sessions they wished to attend, while the ladies boarded buses for a tour of the university hospital.

The morning agenda included two discussions on "CO_2 Welding," by E. J. Bichsel, manager, special products engineering, Welding Dept., Westinghouse Electric Corp.; and Albert J. Dearing, supervisor of Welding Research, A. O. Smith Corp. Other topics were: "Electric Discharge Machining," Vic Matulaitis, director of research, Elox Corp.; "Hydroform and Hydrospin," Alfred C. Jarris, sales manager, Process Machinery Div., Cincinnati Milling and Grinding Machines, Inc.; "Electroforming," Vernon A. Lamb, assistant chief of the Electrodeposition Section, Div. of Chemistry, National Bureau of Standards; and "Processing of Foundry Cores by the Carbon Dioxide-Sodium Silicate Method," Fred C. Seefeldt, manager, gas sales engineering dept., The Liquid Carbonic Corp.

Tom Ryder, chairman of the Industrial Engineering Association of Iowa, and Vernon G. Peters, chairman of the Waterloo Technical Society, presided over the afternoon session. First on the agenda was "Ceramic Cutting Tools," a panel lecture presentation with Moderator K. J. Trigger, professor of the Dept. of Mechanical Engineering, University of Illinois; and panel members including R. J. Hook, chief metallurgist, The Warner & Swasey Co.; H. J. Siekmann, manager, applied Mechanical Engineering, Carboloy Department of GE; and W. B. Kennedy, chief of the Experimental Machining Branch, Watertown Arsenal. "Chem-Mill Process" was the title of George H. Fox, Jr.'s session. Mr. Fox is assistant sales manager, Chem-Mill Div., Turco Products, Inc. of Los Angeles. Other sessions were "Two Types of Tape-Controlled Machines" by Miles V. Hayes, assistant to the manager of research, Jones & Lamson Machine Co.; "Potting, Encapsulating and Tooling with Plastics" by Jerome Formo, director of plastics research, Minneapolis-Honeywell Regulator Co.; "The Hot Extrusion of Metals," R. L. Hugo, Jones & Laughlin Steel Corp.; and "Numerical Control of Milling Machines," Harry E. Ankeney, Giddings & Lewis Machine Tool Co.

Concluding the day's activities was the banquet, at which Kenneth J. Trigger outlined the functions of the ASTE National Education Committee, and Norman B. Mears, general manager, Buckbee Mears Co., gave a highly informative and entertaining discussion of "Acid Etching of Precision Parts."

Past President Howard C. McMillen presents a plaque to Dean Francis M. Dawson, of the State University of Iowa, in recognition of the years he has devoted to the advancement of engineering education.

Lee Pilgrim of the Bendix Co. tests the light weight of plastic molding and tooling devices as Fred Roth, John Deere Co., and Ivan Gezel, Neo-Ray Products, look on.

Moderator of the Ceramic Cutting Tools panel, K. J. Trigger, is shown talking with panelists R. J. Hook, standing, right; H. J. Siekmann, seated left; Thomas Ryder, and W. B. Kennedy.

Ladies enjoy a coffee hour preparatory to discussions and tour of the University Hospital.

aste Scholarship Winners

awards total $7000

President Harold E. Collins announced the ten winners of ASTE's International Educational Awards at the 1957 convention. Applicants were judged by the Society's National Education Committee on the basis of their scholastic standing and interest in furthering the profession of tool engineering as well as faculty recommendations. The grants will be made effective in September. Award winners and the colleges they are attending are, left column, from top: Porter J. Clark, University of Kansas; William H. Bardens, University of Illinois; Phillip F. Myers, Ohio State University; Harold A. Cantrill, California State Poly; and Richard L. Barnoski, University of Missouri. Right column, from top are: Lawrence W. Miller, Case Institute of Technology; Robert K. Burroughs, University of Cincinnati; Peter C. Fishburn, Pennsylvania State University; Paul H. Newell, Jr., University of Tennessee; and Richard W. Warkentin, Queen's University, Kingston, Ontario.

AUSTRALIA

on the air

John Finlay is pictured receiving the chairman's pin from Secretary Colton at the Sydney, Australia chartering ceremonies.

chartering night

Chairman John Finlay is shown taking part in the trans-oceanic broadcast by which Sydney was chartered.

Taking the oath of office by radio telephone are, from left: J. Frail, standing in for A. Welsh, who was unable to attend; J. Marshall; Olive Symons; H. Colton; C. Curtis; J. Finley; R. Howells; R. Cowee; F. Walker; R. Single; J. Maggs; and J. Finlay, Jr.

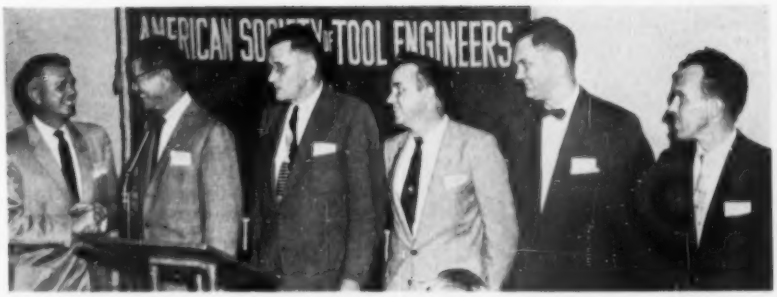
TRI-CITIES—New officers pausing for an official portrait are, from left: Clifford Vogt, treasurer; Robert Larson, secretary; Dan J. McKeon, chairman; Rayburn Knabe, retiring chairman; Albert V. Walle, first vice chairman; and James Rosborough, second vice chairman.

CINCINNATI—New officers seated from left are: Broadus Rusk, second vice chairman; Moler A. Duff, Jr. chairman; and Julius Steinhoff, first vice chairman. Standing are: Frank Kutz, treasurer; Max Kronenberg, delegate; and Frank H. Houston, secretary.

1957-1958 CHAPTER OFFICERS

WILLIAMSPORT—Harry B. Osborn, Jr., past national president, second from left, acted as installing officer for new chapter executives who are, from left: L. E. Zimmerman, first vice chairman; William Beach, chairman; R. E. Bates, second vice chairman; S. C. Fry, secretary; and S. L. Skowronski, treasurer.

LONG BEACH—Raymond E. Gariss, retiring chairman and national delegate, presided at the installation of new officers. Seated are National Vice President Wayne Ewing, the installing officer; J. H. Medford, incoming chairman; C. W. Ward, first vice chairman; and G. C. Allen, second vice chairman.



NORTH TEXAS—F. Paul Simpson, left, retiring chairman, congratulates the incoming chairman, L. Douglas White, while other new officers look on. They are: Louis Jaenecke, first vice chairman; Lee Edmundson, second vice chairman; Ben Harris, secretary; and E. D. Adams, treasurer.

ANN ARBOR—New officers seated from left are: Laurence Charnitsky, second vice chairman; David Peterson, chairman; and Filibert Boston, secretary. Standing from left are: Albert Bethke, treasurer; and Hector Haas, delegate.

LOUISVILLE—Newly installed chapter officers for the year 1957-58 are, seated: Robert Wohlheuter, chairman; J. R. Davis, retiring chairman and delegate. Standing are, from left: J. J. Schell, first vice chairman; J. Cleveland, second vice chairman; E. W. Klein, secretary; and W. M. Exely, treasurer.

DENVER—New officers who will lead the Denver chapter activities are, from left: chairman, Clyde P. Elliott; first vice chairman, Robert M. Farnsworth; second vice chairman, Byron McPherson; third vice chairman, Henry Rudolph; secretary, Russell T. Anderson; treasurer, John D. Nosler; and delegate, George Buckel.

DECATUR—Newly elected officers are seated from left: Robert Mintler, treasurer; Wallace Weatherholt, chairman; and Bedford Hart, secretary. Standing are Kenneth Hurt, second vice chairman; and Wayne Thomson, first vice chairman.

WESTERN RESERVE—Installed during closed circuit proceedings are: Gene Hagman, secretary; Charles Ramsey, second vice chairman; Ed McCabe, chairman; Don Ziliox, toastmaster for the evening; Gene Boron, first vice chairman; Steve Millik, third vice chairman; and Paul Messina, treasurer.

new chapter officers

GREATER NEW YORK—New officers seated from left are: first vice chairman, James L. FitzPatrick; chairman, Fred W. Bechtold; and delegate, William F. Reber. Standing are: second vice chairman, Alfred M. Sampter; secretary, Kenneth W. Sandberg; and treasurer, Walter Middleton.

SEATTLE—New officers from left are: A. V. Bingham, treasurer; John Mitchell, secretary; Gordon Duncan, second vice chairman; Clarence J. Downie, chairman; Carl Carlson, first vice chairman; and John L. Fellows, past chairman, who is passing the gavel to the new chairman.

MANSFIELD—Repeating the oath of office during the anniversary broadcast are new officers: Mel Brooking, second vice chairman; William Burrer, first vice chairman; David F. Cole, chairman; Donald D. Smith, secretary; and Ferd Loykovich, treasurer. William Moreland, of this chapter, was named a national vice president.

MADISON—New officers installed during the closed circuit anniversary broadcast are, from left: Joe Markvart, third vice chairman; Lyding Haver, second vice chairman; Chester Fredericks, first vice chairman; Arvil Mergen, chairman; J. L. Murray, retiring chairman; Roy Lindberg, secretary; and Richard Wuerch, treasurer.

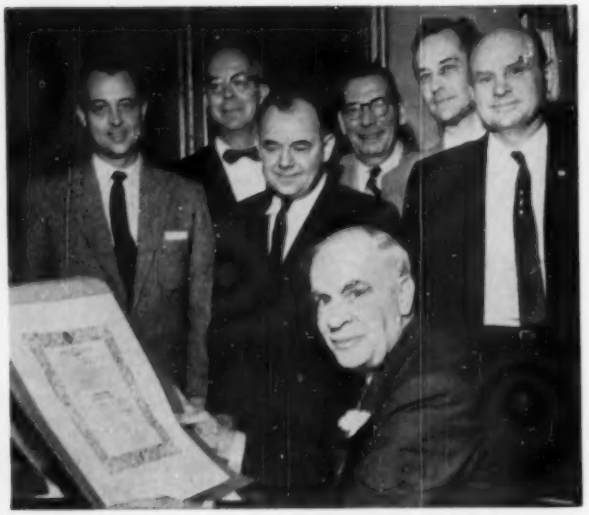
OAKLAND COUNTY—Chapter's new officers pose for their portrait. From left are: C. M. Bay, chairman; E. C. Barnhart, first vice chairman; E. C. Richards, second vice chairman; Emerson Brown, secretary; L. J. Hope, treasurer; A. E. Forster, delegate; and Charles King, alternate.

MUSKEGON—New officers installed on March 25 through the audio broadcast from Houston are: Albert Schrebe, treasurer; Gordon Carlisle, secretary; Willard Bierema, chairman; Vernon Nephew, past chairman; Jay Retsema, first vice chairman, and John Vanderlaan, second vice chairman.

BOSTON—John X. Ryneska, left, national treasurer, is installing Boston's new officers at ladies night: Frank D. Clark, chairman; John L. Morosini, first vice chairman; Charles Moody, second vice chairman; Seymore J. Benedetto, treasurer; Joseph V. D'Avalla, secretary; Thomas B. Walsh, immediate past chairman and national delegate. John L. McAvoy, newly appointed membership chairman, was awarded a service pin for his outstanding performance of the duties of arrangement committee chairman for the past year.

LaCROSSE—Shown at the recent installation night proceedings are, from left: Wesley Bertelson, retiring chairman; William Nichols, treasurer; Burton T. Hanson, secretary; Velmor Rohde, chairman; and Eldon Bruha, vice chairman.

PITTSBURGH—Joseph Jennison, manager of South Pittsburgh Tool Co., stoops to blow out birthday candles after wishing the Society success in the next 25 years. Watching are, from left: R. J. Zale, second vice chairman; W. F. Coles, treasurer; and E. L. Caughey, toastmaster for the March 25 ceremonies.



PIEDMONT—Governor Luther H. Hodges of North Carolina displays the resolution presented to him by the chapter. Standing are, from left: Jack Reilly, chairman of Raleigh-Durham; Piedmont officers H. I. Newsome, Robert Schneider, Roy Palmer, Sidney B. Jeffreys, and E. M. Ketchie, chapter chairman.

UTAH—Governor George D. Clyde of Utah signs a declaration designating March 25 as "Tool Engineering Day" in Utah. Shown with him is National Director Leslie C. Seager of Salt Lake City. Utah is tool engineering-minded, being one of the few areas where a four-year college course in this branch is available.

chapter news and views

Hartford Celebrates Society Anniversary

Previous to the closed circuit broadcast emanating from Houston, members of the 21-year-old Hartford chapter dined in the Pratt & Whitney Co. Men's Club and toured two of the company's precision departments which manufacture machine tools and gages.

On March 9, 95 couples attended ladies night at Indian Hill Country Club in Newington, Conn. During the meeting, the special-service award was presented to L. Girardi, and officers were installed by National Director Philip Marsilius. —*C. Morgan Newbury*

ASTE representatives from Belfast, North Ireland, who are studying United States industry, stopped at headquarters on their trip across the country. From left are: David Woods, managing director, Belfast Tool & Gauge Co., Ltd.; Thomas Kee, managing director, W. E. Stewart Industrial Services, Ltd.; and William Baird, public relations assistant at headquarters.

Automation Seminar To Be Held June 9-14 On Penn State Campus

Latest developments in automation equipment and techniques provide the basis for an intensive week-long seminar scheduled for June 9 to 14 at Pennsylvania State University. Conducted by the school's college of engineering and general extension, the course is again sponsored jointly by ASTE's Williamsport chapter and the National Association of Manufacturers. Chairman of the programs is Prof. Chester Linsky, who heads Penn State's automation development.

Special emphasis is being placed upon the planning and installation of automated equipment for in-process transfer, small parts handling and positioning, and various types of automatic control systems.

Papers dealing with theory, design, control operation and maintenance of automatic devices are planned for morning sessions of the seminar. On the afternoon agenda are workshops tackling problems of basic and advanced control systems, special purpose equipment, and automatic feed and positioning devices.

Among automation experts conducting lectures and workshops are H. Alspach and A. F. Maynard of GE; Sulo Aijala of Metals and Controls Corp.; W. F. Jessup of The Cincinnati Milling Machine Co.; L. R. Martin of Eastman Kodak Co.; W. A. Kaufman, IBM Corp.; and A. V. Bodine of the Bodine Corp.

Fee for the one-week seminar is $50, which should be mailed to: T. Reed Ferguson, Extension Conference Center, Pennsylvania State University, University Park, Pa.

LITTLE RHODY—Looking over Governor Roberts' proclamation naming March 25 as "Tool Engineers Day" are H. B. Nihill, public relations chairman, and Horace Bennett, chapter chairman. —*H. B. Nihill*

HARTFORD — Welcoming tool engineers previous to a tour through the Pratt & Whitney Co. is E. P. Gillane, president. Seated from left are: J. B. Wilkie, general manager of the Gage Div., and chairman of the event; Paul Dillberg, first vice chairman; A. Douglas Proctor, secretary; and Paul Pick, treasurer.

Macomb Chapter Tours Plymouth Engine Plant

The Plymouth Engine Plant opened its doors to over 140 members and guests of Macomb chapter recently.

Of special interest to the group was the machining of both 2 and 4-barrel carburetor intake manifolds by the same machine, accomplished by selector switches which pick up small projections cast in a different location in each, thus "telling" the machine which spindles to use. Members learned that over 200 units per day have been produced by this 565-foot line, and that every engine produced is operated at normal running temperatures for twenty minutes in an exhaustive checking operation before being released.

At the previous month's meeting, held in the General Motors Technical Center, Dr. Charles Irwin presented a humorous talk entitled "The Five Little Imps of Communication."—*F. J. Busch*

SANTA ANA VALLEY—Roy Connelly receives the gavel and chairman's plaque from David Reichert.

Piedmont Commends North Carolina Governor

A delegation of officers from Piedmont chapter, along with the chairman of the Raleigh-Durham chapter, presented North Carolina's Governor Luther H. Hodges with a hand-tinted resolution, commending the governor for his progressive action in fostering industrial development in the state. The resolution further stated the willingness of the chapter to support this development, and to encourage other engineering societies and organizations to actively support the state-wide program.

The resolution, printed on parchment, was surrounded by a scrollwork, border designed and painted by Karl Smith, vice president of Dillard Paper Co., Greensboro, N. C. It incorporated insets depicting some of the first machines, the symbol of the Piedmont chapter, and the symbol of ASTE. —*E. T. Mulvey*

Baltimore Discusses Radioactive Isotopes

First Lt. Frank W. Dallon of the Ordnance Explosive Disposal Office, Aberdeen Proving Ground, discussed "Industrial Application of Radioactive Isotopes" at Baltimore's meeting held at the Engineers Club. Lt. Dallon summarized available data and then presented a basic atomic theory which equipped his audience to follow the remainder of his talk with some basic knowledge of atoms. By means of slides Lt. Dallon showed how modern industry is using radioactive particles for tracking and control devices.—*E.V.Kapp*

Chapter News and Views

PITTSBURGH—Past President Harry B. Osborn, Jr., right, presents the chairman's pin to J. A. Bircher, incoming chairman, at the installation proceedings. Seated is J. R. Weaver, past president, and charter chairman of the chapter.
—J. A. Bircher

Machinability Subject At Hamilton Meeting

At a recent meeting of Hamilton chapter, Clifford Williamson, sales department supervisor, Carboloy Div., Canadian GE, Ltd., discussed how a better understanding of machinability will aid in carbide tooling practices. Assisted by A. Jackson, also of the Carboloy Div. of Canadian GE, Mr. Williamson went on to define machinability as the "variables that affect metal-cutting."

Mr. Williamson gave a demonstration of the Carboloy Machinability Computer which is used to solve tooling problems. He explained that the 19 major variables were grouped into three categories in the computer; (1) material to cut; (2) cutting tool characteristics; and (3) cutting conditions. By putting the known variables into the computer it was possible to determine the unknown variable within a matter of minutes, as against the hours of lengthy calculations by ordinary methods.

The first life membership in Hamilton chapter was presented to Jack Walton who has been a member since 1941 and who was chapter chairman in 1946. Chapter Chairman Harry Ward presented the certificate and John Burk of Toronto spoke briefly in tribute of Mr. Walton's work in tool engineering.

Announcement was made that Archie Corkigian had won a third prize award in the recent gadgets contest.
—Russ Wilson

Akron Mayor Proclaims Tool Engineers Week

Mayor Leo A. Berg addressed Akron members and guests on the subject of the tool engineers' contributions to American industry. Mr. Berg pointed out that tools have already given us the highest standard of living in the world, and that the country will rely upon them to maintain this position. At the completion of Mr. Berg's talk, the group listened to the 25th Anniversary closed circuit broadcast from Houston.

Coffee speaker of the evening was George A. Irwin, past chairman. New officers and past chairmen were introduced. *—Jack L. Mitchell*

HAMILTON—Standing from left are: George Bowie, General Motors Diesel, Ltd.; and J. A. Sheldon, chairman. Seated: G. Churchill and R. Fechnay.

Carbide Cutting Tools Described at San Antonio

Speaking at a San Antonio technical session, W. E. Montgomery, chief tool engineer of Firth Sterling Inc., Pittsburgh, gave an excellently presented talk on carbide cutting tools. The lecture was supplemented by slides illustrating such brazing difficulties as the coefficient of expansion and deformation. Mr. Montgomery emphasized the superior cutting characteristics resulting from the departure from brazed carbide to the present improved mechanical clamping methods, as used by his company. Robert E. Lewis, Southwest district manager, and H. J. Ritchey, Jr., Houston Division plant manager of Firth Sterling, accompanied him.

The meeting was concluded with a short report by National Delegate James Frix on actions taken at the delegates' conference. *—S. G. Gower*

Seattle Sponsors Engineering Banquet

Dr. Harry B. Osborn, Jr., former national president, was guest speaker at the annual banquet of the Puget Sound Engineering Council banquet, which was sponsored by Seattle. Preceded by W. Carl Fields, first chairman of Seattle, who spoke on "What Is a Tool Engineer," Dr. Osborn addressed the group on the subject of "Creative Engineering."

C. J. Downie, chairman-elect, was banquet chairman of the event, and Frank J. Stasny acted as program chairman for Seattle Chairman John L. Fellows. *—John L. Fellows*

SOUTHEASTERN MASS.—Mr. Kiefaber, center, assistant supervisor, sales engineering, Sheffield Corp., spoke on design, development and use of air gaging cartridges. Lou Ferraresi, left, is program chairman, and Ralph Manchester, right, is chairman. Carl Nittel was honored as third prize winner in the Gadgets Contest. *—E. L. La Broad*

Erie Makes Tour of Hammermill Paper Co.

Greeted by John A. Claridge, who is in charge of community relations at Hammermill Paper Co., Erie chapter embarked on a very extensive and informative plant tour in April.

On March 25, Erie joined with all of the Society's chapters to celebrate ASTE's silver anniversary. During the dinner, six models presented a style show of women's clothing. Later, short talks were given by Past Chairman Stanley Sadoski who replaced David B. Schuler who was in Houston; Clare Swisher, editor of "The Erie Story"; and Robert Hickey, secretary to the mayor, who read the proclamation "Tool Engineering Week in Erie."

Anthony Jaworowicz received the service pin award.

ERIE—Erie's Mayor Arthur J. Gardner presents the proclamation of "Tool Engineering Week in Erie" to incoming chairman, H. W. Sedler, while retiring chairman, David B. Schuler looks on. *—Leo B. Weiner*

Engineering Shortage Topic at Columbus

Executives of local industry and educators from surrounding communities met at The Athletic Club in Columbus for a special program organized by the Columbus chapter.

Coffee Speaker James Garfield Stewart of the Supreme Court of Ohio gave an entertaining talk. H. E. Linsley, associate editor of *American Machinist*, gave the members and guests some informative figures and reasons for the shortage of engineers and discussed ways to alleviate the problem.

President H. E. Collins discussed ASTE's role in meeting the problem of the engineering shortage.

—G. E. Rauberts

TUCSON—John W. Greve, editor of *The Tool Engineer* is shown congratulating John Oberteuffer for chapter growth and activity in the past year. From left are: Cy Jacobson, past chairman; Mr. Greve; John Oberteuffer, immediate past chairman; Harvey Hersey, editorial chairman; and Harry McClain, past chairman. Treasurer Joseph W. Vincent took the picture. *—Harvey K. Hersey*

ST. LOUIS—Looking on as Mayor Raymond Tucker signs the Tool Engineers' Week Proclamation are, from left: Kenneth Ritter, second vice chairman; Paulena Pagel, secretary; Vincent L. Bene, chairman; Frank C. Schillinger, treasurer; and Clarence Hall, past chairman. Mayor Tucker addressed the chapter on the night of the 25th anniversary. *—W. A. Russel*

Miss Pagel, Registered Professional Engineer, Elected Secretary

St. Louis chapter elected its first woman professional engineer to the office of secretary. Miss Paulena A. Pagel is a tool design engineer for the Ramsey Corp. of St. Louis. She received a diploma in mechanical engineering from the International Correspondence School and graduated with a B.S. degree in mechanical engineering from Washington University in 1952. Miss Pagel passed her engineering exams in October of last year.

She has been a member of St. Louis chapter of ASTE since 1949 and was the 1956-57 chairman of the Society of Woman Engineers, St. Louis chapter.

Chapter News and Views

INDIANAPOLIS—J. Y. Riedel, center, tool steel engineer, Bethlehem Steel Co., addressed the chapter on improving production through proper design of tools and sound selection of tool steel grade, proper heat treating and grinding practices and correct application of tools in service. Talking with Mr. Riedel are, from left: Kenneth Hiatt, program chairman, and Richard Garber, chairman. *—R. E. Morris*

Santa Clara Discusses Special Tooling

Roy A. Tassi, supervisor of manufacturing engineering at Westinghouse Electric Corp., Sunnyvale plant, discussed special tooling before a group of 70 members meeting at the Old Plantation Inn in Los Altos. Mr. Tassi discussed the problems which Westinghouse encountered in the manufacturing of turbine blade and spindle disks, and how these problems were solved by special tooling. Machining spindle disks to a tolerance of 0.000 was done with a form cutter on a modified G & E gear hobber. *—Dresden Smith*

Los Angeles Joins Anniversary Celebration

Los Angeles chapter members combined Ladies Night and Past Chairmen's Night with the closed circuit broadcast from Houston on March 25 to celebrate the 25th anniversary of the Society. This chapter is approaching its own 18th birthday, having received its charter on July 20, 1939.

The audio program was supplemented with an address by Frank P. Carroll, civil engineer with the U. S. Army Corps of Engineers, whose subject was "Flood Control." High point of the evening was the presentation of "Certificates in Recognition of Meritorious Services to ASTE" to all chapter committee chairmen by Ben J. Hazewinkel, acting as temporary chairman in the absence of Francis X. Bale, retiring chairman.

Mr. Hazewinkel introduced Warren Biscailuz, who represented Mayor Norris Pouson of Los Angeles in sending greetings to the Society. A message from California's Governor Goodwin J. Knight was also read, in which he congratulated ASTE on its Silver Anniversary. *—Gene Grahn*

DES MOINES—Retiring Chairman J. E. Scanland is shown presenting Alex Wayne the chairman's pin as Past Chairman Hug looks on. *—John Hug*

Movie "First" Seen By Schenectady

Representatives of Republic Drill & Tool Co. addressed Schenectady chapter on the subject of manufacturing drills and reamers. Edward Evildsen and Edward Berrett showed a complete movie taken at their New York, Chicago and Los Angeles plants showing special machines and applications invented for making various sizes and types of drills and reamers accurately and efficiently. A first for an ASTE chapter, the movie had never been shown except to drill manufacturers here and abroad.

—George S. Nelson

Phoenix Members Learn of Transistors

Addressing Phoenix members at a recent technical session was Dr. Virgil Bottom, chief of product development at Motorola Semi-Conductor Div. in Phoenix. Dr. Bottom traced the history of the semi-conductor to its invention in 1948, when it was called a transistor. The same basic principles behind these devices were used in the early days of radio, in crystal sets. Not until after World War II was much technical effort expended toward the development of this device. He mentioned silicon and germanium as the principal metals now used in modern applications.

Crystal growth, diffusion, alloying, and zone refining were explained to the members by Dr. Bottom. Photographs of some of the tooling applications in transistor assembly were shown, as were samples of the items constituting a complete transistor unit.

Following the talk, installation ceremonies were held for the 1957-58 chapter officers. John Hamay was voted the recipient of a merit pin because of his contributions to ASTE. *—John Hamay*

Portland, Ore. Makes Field Trip to College

Oregon State College campus at Corvallis was the scene of a field trip by members of the Portland chapter recently. On the agenda were tours of the college laboratories, luncheon at a local restaurant, with a talk by the dean of the engineering school, and for those who wished, a side trip to Eugene, Ore., to watch a basketball game between Oregon State College and the University of Oregon.

George W. Gleeson, dean of the School of Engineering and Industrial Arts, had as his subject, the seeds of destruction. His talk was titled "History Does Not Repeat Itself—Man Repeats History." *—Walter Brenneke*

DAYTON—Members of the panel on automation are, from left: R. J. Kaehler, National Cash Register Co.; John Hoback, Airtemp; Jack Welsh, program chairman; C. E. Nordquest, Frigidaire, General Motors; George Brandt, chapter chairman; H. A. Huddleston, Moraine Products, General Motors; and Henry Boppel, Sheffield.

Tape-Controlled Tools Topic at Worcester

Speaking before Worcester members recently was Murray A. Kanes, manager of the electromechanical development department of Bendix Aviation. His topic, "Tape-Controlled Machine Tools," proved to be one of the most interesting of the year. Mr. Kanes described the production of three-dimensional control tape with a computer translating process data. He spoke of the extreme tolerance and finish that can be acquired and, in comparing costs to standard shop methods, showed the tape control to be more economical.

The speaker stated that, in addition to milling, potential applications of this method of control include boring, grinding, planing and many other machining processes. The more generally used applications will be mainly on short runs where a high degree of versatility will effect quick change-over in job shop operation, and prove useful for complex parts, for jobs requiring better quality than is now available, and for making tooling.—*Robert A. Cusson*

New Haven Hears Anniversary Program

New Haven members had a "three in one" program March 25, when the Society's Silver Anniversary was celebrated jointly with Past Chairmen's Night and Installation Night. Ten past chairmen who attended the meeting included: Andrew Schoefler, 1941; Gus Weldon, 1942; Fred Dawless, 1943; John Sargent, 1945; and Frank Shute, 1946. Also present were Raymond Gifford, 1947; John Alton, 1952; David Matthewson, 1953; Charlton Gilbert, 1955; and Stanley Porritt, 1956.

After the installation, members heard Max Schrack, a representative of the Carl Hirschmann Co., Inc. of Long Island, present a film on the Swiss Tornos screw machine. —*S. W. Becroft*

ROCKFORD—Joel Jannenga, left, past chairman, and Walter Fraser, chairman, discuss plans for their trip to the convention in Houston. Photo by National Lock Photo. —*Lawrence Geiger*

PEORIA — Michael Jakcsy, left, business manager of *The Tool Engineer*, was guest at the meeting at which Edward J. Ball, center, gear analysis engineer from National Broach Co., spoke on gear honing and shaving operations. Also shown are Mel Burdette, second from right, who was technical chairman, and Vincent Hodel, both from Caterpillar Tractor Co. —*S.J.Schumacher*

HARTFORD—Newly elected chairman, Harry Anderson, is shown receiving his pin from Philip Marsilius.

SCHUYLKILL VALLEY—Pictured from left are Donald Bassler, program chairman; John Wright, sales engineer, Henry & Wright Dieing Machinery Co.; John Quinn, Jr., chairman; and William Schug, liaison engineer, V & O Press Co.

Crush Form Grinding Topic at Schuylkill

John C. Wilson, sales manager, Thompson Grinder Co., addressed 80 members on the subject of crush form grinding, stressing the most advantageous uses of diamond dressing and of crush form grinding.

At the chapter's April meeting, 50 members attended to hear talks by John Wright, sales engineer, Henry & Wright Dieing Machinery Div., and William Schug, liaison engineer, V & O Press Div., Emhart Mfg. Co. Mr. Schug discussed uses of V & O presses and press automation, and Mr. Wright presented a film on dieing machines.

—*W. Robert Yeich*

Wichita Chapter Has Busy Spring Schedule

Three activities within a month make Wichita chapter one of the more active groups across the nation. The Silver Anniversary dinner on March 25 was sandwiched between two technical activities—a plant tour of the Beech Aircraft Co., and a regular technical meeting, at which members heard about "Precision Cold Stretch Forming of Metals," presented by Lawrence Allison of the Cyril Bath Co., Solon, Ohio. Mr. Allison showed a film on this process and gave a brief summary of the new "Bath yield control mechanism."

At the Beech tour, Harold Showalter, manufacturing engineer, pointed out the diversification of Beech, which ran the span from commercial aircraft to military prime and subcontracts, and the fuel tank program. Highlight of the tour was the Turco Products "Chem-Mill" setup.

At the anniversary dinner, all new officers were present for the installation by audio broadcast, with one exception.

Heat Treating Topic At Cincinnati Meeting

Members and their guests met at the Engineering Society headquarters for dinner and an entertaining film about the piranha, a cannibal fish of South America. Moler Duff, Jr. called the meeting to order and Barton Jones, entertainment chairman, discussed plans fr the nineteenth annual dinner.

Broadus Rusk introduced Speaker A. F. Holden of the A. F. Holden Co., who spoke on salt bath heat treating of tools and dies. Of particular interest to the group were his comments on how to avoid distortion during the process of hardening and tempering.

—*Frank H. Houston*

Chapter News and Views

LOS ANGELES—Past chairmen and their wives attending the chapter's Silver Anniversary celebration are, from left: Les Haws; Mrs. and Mr. Tony Peck; Mrs. Paul Slater; Mrs. Les Haws; and Paul Slater. Past Chairmen's Night and Ladies Night were also celebrated, with ladies receiving orchid corsages.

Long Beach Celebrates Past Chairmen's Night

Past Chairmen's Night was combined with the installation of officers at Long Beach chapter's recent meeting. In attendance were Charter Chairmen J. Y. Stansbury, W. B. McKay, F. D. Wallace, and L. D. Pomerantz.

Installation ceremonies were conducted by Wayne Ewing, national vice president. Chairman R. E. Gariss presented the yearly service pin award to J. A. Espy, for outstanding service to the chapter during the past year.

Patrick S. Doyen, sales engineer for Eureka Tool and Die Co., spoke on special applications of welding tools and dies. *Daniel B. Welty*

Panel Discussion Presented at Philadelphia

"Carbide Night" at Philadelphia featured a panel discussion on shaping and planing with carbides by four experts on the subject. Moderator for the panel was H. O. Fullam, vice chairman of the C. H. Wheeler Co. Panelists were M. Colombrita of Gould and Eberhardt Co.; H. J. Knox of the Gray Co.; and O. C. Trabert of The Budd Co.

M. Colombrita spoke on shaping with carbides versus high-speed steel, using a specific set of machining conditions in the shaping of mild steel. Carbides were found to be superior, with a reduction in scraping time on machine parts, an increase in production, and comparable reduction in cost. He concluded that the carbide applications were the more successful.

O. C. Trabert listed the essentials necessary for good carbide performance as first, a machine that is in good condition, rigid, with sufficient horsepower, special tool lifters and proper speeds and feeds; and second, a tool of the clamp-on or solid type, of the proper grade, having a chip breaker. The tool should run at speeds four to five times that used with high-speed steel, and stoning, roughing or finishing tools should be avoided. He noted that chip removal is still a problem due to the high speeds used but, in spite of this, carbide shaping and planing have proven successful at his company.

In the discussion of finish planing with carbides, H. J. Knox noted that round-bottom tips worked well on cast iron, while the regular tip was preferable for steel. If tolerances greater than one or two thousandths are required, high-speed steel must be used.
—John Chernokreluk

WORCESTER—Ten past chairmen who attended the recent Past Chairmen's Night were, standing: Ralph Rawlings, Carl Schofield, Jr., Irving England, Carroll Morse, and E. R. Ljungquist. Seated, are: Adam Kosciusko, John Rotchford, Albert Warman, John Lindegren, and Ralph Baker. *—Leon F. Miller*

Obituaries

Albert Bailey, Springfield, Mass., staff assistant, American Bosch Arma Corp.

Charles W. Ballard, Houston, owner, United Grinding Service, Inc.

Harry W. Barkley, Cleveland, president and general manager, National Tool Co.

Eugene Bouton, charter member Racine, employed by Massey-Harris-Ferguson, Inc.

Joseph Champoux, Sr., Twin States, owner Champoux Machine Co.

Thomas T. Connelly, Philadelphia, owner of Thomas T. Connelly Co.

A. William Cordonna, Philadelphia, district sales manager, Pratt & Whitney.

M. W. Denson, Elmira, vice president and superintendent of Shepherd Niles Crane and Hoist Co.

Harvey Ellis, Buffalo, branch manager, Syracuse File Co.

Paul C. Hermansdorfer, Richmond, tool designer, National Automatic Tool.

A. H. Hitchcock, New Haven, owner A. H. Hitchcock Co.

John A. Hornell, Chautauqua-Warren, toolroom foreman, Marlin Rockwell Co.

Michael Kost Jr., Baltimore, machine shop training coordinator, The Martin Company.

Harold Joseph Oliver, Macomb, senior designer, leadoff, Fisher Body Div., General Motors.

Francis A. Paquin, Sr., Paterson, chief engineer, Paquin Designing Co.

Frank Therrien, Sr., Montreal, senior manager, RCA Victor Co., Ltd.

John R. VanDyke, Dayton, gear process engineer, Master Electric Co.

William E. Wheaton, Northern New Jersey, planning engineer, Walter Scott Company.

chips and chatter

Akron's new chapter officers are Charles Dralle, chairman; Elwood Gill, first vice chairman; Harold Hawk, second vice chairman; Clyde Fagan, secretary; and Joseph Koza, treasurer.

R. N. McGee of Jones & Laughlin Steel Corp. discussed the age of steel at a recent meeting of the **Cincinnati** membership. Barton Jones received the chairman's award pin for the most outstanding committee job of the year.

Past Chairman John Hug installed new officers at **Des Moines** chapter's March meeting: Alex Wayne, chairman; William S. Roush, first vice chairman; H. S. Snodgrass, second vice chairman; O. A. Olson, secretary; and Roger E. Brumble, treasurer.

Robert Triplett of the Delavan Mfg. Co. of Des Moines was the coffee speaker who discussed "Training Future Tool Engineers." Jack Schaeffer, representing the Pacific Industrial Mfg. Co. of Kansas City, gave an informative talk on hydraulic presses, brakes and shears, accompanied by a color film showing applications of hydraulic presses.

Fort Wayne has presented the Indiana Technical College with $100 for its building fund and a handbook for its library.

Indianapolis heard a talk by Past Chairman Joseph N. Huser, president and general manager of the B & H Tool & Machine Co. Mr. Huser is a past president of the National Tool & Die Manufacturers Association.

W. S. Wagner, research and development engineer for the E. W. Bliss Co., spoke before **Kansas City** on metals and their reactions to various machining operations, dwelling on the "plastic range" of metals. Present were Roger Kirkwood, editor of *Midwest Industries* magazine, and four new chapter members.

Lima members heard W. S. Humphreys, Jr., director of American Lava Corp.'s ceramic cutting tool program, discuss the fabrication of ceramic tools, along with successful applications to date, the future potential of the tools, and the machinery needed for their effective use.

"Modern Trends in Screw Machines" was the topic of Oscar T. Lippman, sales engineer of Brown & Sharpe Mfg. Co. at **Little Rhody** recently. Guests of the chapter were Robert A. Wason III, associate editor of THE TOOL ENGINEER, and Walter Mollenauer, membership chairman of Pittsburgh chapter.

ASTE's 141st chapter, **Mississippi,** heard three technical speakers and a report by its chairman, George Mitchell, on the Houston convention, which he had attended. On the technical side, Dick Seay covered the topic of precision ground stock and its value to industry, while Charles Nesbitt of O'Neele Steel Co., Birmingham, Ala., and George Barker, Bethlehem Steel Co., followed up a film on "Teamwork of Tool Steel" with additional facts on the subject.

Montreal members learned of short-run piercing methods from John H. Powers, Jr., Wiedemann Machine Co. He stressed the economies possible by using turret type presses on short runs, explaining that what constituted a short run was purely relative. At the same meeting, the 1957-58 officers were installed, headed by the new chairman, Ted Nashman.

Eli Whitney Technical School in Hamden was visited by **New Haven** members as a recent chapter function. The modern brick building surrounded by several acres of ground was toured by the visitors, who saw an up-to-date training school where trades of all kinds, from machining to nursing are taught. The chapter has contributed money and books to students here excelling in machine design.

Another New Haven project has been the presentation of a three-lecture educational series during the month of March at the Mason Mechanical Engineering Laboratory. The lectures and speakers were: "Screw Machines" by Oscar T. Lippman of Brown & Sharpe Mfg. Co.; "Eyelet Estimating and Tooling" by Howard B. Finkenzeller of Risdon Mfg. Co.; and "Hydraulic Press Tooling" by Francis F. Springer of Denison Engineering Co.

Van Buren F. Hopps, personnel manager of Kendall Mills, had as his topic, "The Art of Creative Thinking" at **Northern Massachusetts'** installation meeting. His presentation included a discussion of brainstorming techniques, and an audience participation of this method of creative thinking.

Northern New Jersey heard C. G. Schelly of the Wilke Foundation lecture on The DoAll Co.'s "Story of Measurement" display at a recent meeting.

For the second consecutive year, **Peoria** chapter participated in the Pekin Science Fair, with a display arranged to stimulate interest in tool engineering and offer technical knowledge to those attending the fair.

Portland, Ore. was among the chapters across the nation that joined the closed circuit broadcast from Houston on March 25. Portland's mayor, Terry Schrunk, proclaimed the week of March 24 through 30 as Tool Engineers Week in the city.

"Metal in Motion," dealing with the design possibilities of the impact extrusion process, was the title of a presentation by Norman Olson and Mark Ziegler before a group of **Rochester** members. Representatives of Aluminum Co. of America, the men supplied samples of parts being fabricated by this method by numerous companies throughout the country, including automotive and aircraft parts manufacturers.

Installation night at **San Antonio** was climaxed by the showing of a film illustrating Alaska as a hunting and fishing paradise. J. B. Frix was awarded an ASTE service pin for services rendered the chapter.

Toledo's annual Ladies Night was celebrated with a dinner dance at the Sylvania Country Club, with over 100 members and their wives attending.

Joining other chapters across the continent in the closed circuit broadcast and installation of officers, **Tri-Cities** supplemented the anniversary program with a banquet attended by 105 members and guests. Banquet speaker was Dr. L. W. Wallace of the Rock Island Arsenal, speaking on "Human Relations." Past chairmen and the ladies present were given a special salute, after which D. B. Cardinal, public relations and editorial chairman, was presented with the ASTE Service Award, in recognition of his service during the year.

Fritz Forsthoefel, sales engineer for Lincoln Electric, addressed **Western Reserve** members recently on the subject of arc welding in tool, die, jig and fixture building and maintenance.

Positions Available

DIE DESIGNER PROGRESSIVE DIES—Minimum of one year actual shop experience, two years on drafting board. Liberal benefits. Salary commensurate with ability. Volkert Stamping, Inc., 222-34 96th Ave., Queens Village, Long Island, N. Y.

DEALERS—Oslund Precision Products, 14 Sigourney St., Hartford, Conn., has territories available throughout U.S.A. A comparatively new, yet very essential item in the machine and toolmaking industry. An opportunity to share in the benefits of a rapidly growing company. Write today for complete details.

ENGINEERS FOR MANUFACTURING—Graduate mechanical engineer with minimum of 10 years' experience in metalworking industry as tool and process engineer. Should have broad knowledge of tools, dies, fixtures, machining and presswork. Experience in electric motor manufacture desirable with additional experience in some or all of the following: die casting, welding, heat treating, plating, plastic molding, ferrous and nonferrous foundry, assembly and testing. Good salary, benefits and working conditions. Write Personnel Manager, The Master Electric Co., 200 Davis Ave., Dayton, Ohio.

MACHINE DESIGNER—We have opening for designer with 5-10 years' experience in special machine and equipment design. Work is varied and interesting. Should be able to design functional machine from original idea with minimum of supervision. Good salary, benefits and working conditions. Write Personnel Manager, The Master Electric Co., 200 Davis Ave., Dayton, Ohio.

MANUFACTURERS AGENTS—Successful machine tool rebuilding concern planning on further expansion. Agents must be familiar with machine tools and deal with owners, plant managers and superintendents of industrial manufacturing concerns. Illinois, Indiana and Michigan territories now open. Liberal commissions. Write stating experience and lines you now handle. Write to Box 099, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

MECHANICAL ENGINEERS AND MACHINE DESIGNERS—At least six years' experience in machine or tool design and related work. Prefer ME degree with supervisory ability to handle design projects for production engineering. Gillette Safety Razor Co., Gillette Park, Boston 6, Mass.

PRODUCT ENGINEERS—Bored with board work? If you have two or more years of drafting, mechanical comprehension and imagination, then here is an opportunity to combine your board work with model making, design experiments, engineering of materials and finishes. Chance to follow the job all the way from sketch to completed product. Gillette Safety Razor Co., Gillette Park, Boston 6, Mass.

REPRESENTATIVE WANTED—Long established and nationally advertised manufacturer of helical reamers desires representation in the North and South Carolina area. State territory covered and lines carried in first letter. Write to: Box 098, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

GREATER LANCASTER—L. A. Hauser, left, metallurgist, Universal Cyclops Steel, is pictured with John R. Folkeson, chairman. Mr. Hauser spoke on the proper application of tool and die steels. Ray Moorehead gave a talk on the convention in Houston at this meeting.

—Donald R. Nunemacher

ROCHESTER—Norman Olson, left, and Mark Ziegler, speakers from Aluminum Co. of America, display samples of impact extruding to illustrate their talk.

—C. W. Greenman

members on the MOVE

H. Charles Yaeger, Cleveland, has been named plant manager of the new Vickers, Inc. plant at Jackson, Miss.

Malcolm F. Judkins, Pittsburgh, who has written for THE TOOL ENGINEER, has been appointed director New Product Development of Firth Sterling, Inc.

Wallace E. Carroll, Chicago, director of the ASTE Research Fund, president and treasurer of American Gage & Machine Co., has been appointed director of the Metalworking Equipment Div. of the Business and Defense Services Administration, U. S. Dept. of Commerce, for a period of about six months.

Precision Supply Co. announces two new appointments: **Frank Angelillo,** Northern New Jersey, to general manager; and **Warren Bollen,** Paterson, president.

R. J. Jablonski, Detroit, has been appointed sales representative for Carboloy in Flint, Mich. area.

William B. Summers, Long Beach, has been transferred from Pacific Coast to Cleveland-Pittsburgh districts for The Carborundum Co.

G. Sobering, Montreal, has been appointed assistant plant manager, Car Division, Canadian Car Co., Montreal.

Charles Haugk, Fort Wayne, has been made tool engineer with Farnsworth Electronics Co.

Robert W. Clark, Canton, has been appointed chief tool engineer for The Hoover Co.

James A. Arney, Seattle, has been made division manager for Southern Indiana and Western Kentucky for The Aro Equipment Corp.

Cincinnati Gilbert Machine Tool Co. has appointed **John W. Daughters,** Cincinnati, field engineer.

John L. Ross, Jr., Peoria, has been appointed sales and engineering representative for the Michigan Tool Co.

Charles E. Woods, Worcester, will retire from Simonds Saw and Steel Co. after a half-century of service.

Herbert B. Clark, St. Louis, has been appointed Eastern district manager for Vascoloy-Ramet Corp.

Arthur J. Durante, Greater New York, has been named vice president-press manufacturing for R. Hoe & Co., Inc.

Paul W. Brannon, Cleveland, has been named factory manager for the Chicago plant of Brad Foote Gear Works, Inc.

Coming Meetings

National

NATIONAL OFFICERS AND COMMITTEE CHAIRMAN—June 8, 9, Detroit.

NATIONAL PUBLIC RELATIONS COMMITTEE—June 14, 15 at Headquarters.

NATIONAL PROFESSIONAL ENGINEERING COMMITTEE—June 7, Detroit.

Chapter

ANN ARBOR AREA—June 10, 7 p.m., Goebel Brewing Co., Detroit. Tour of plant for members only. June 1, all-day annual golf outing, Lakeland Country Club.

BIRMINGHAM—April 19, 3:30 p.m. Camp Cosby. Annual family-style picnic.

BOSTON—June 8, 9 a.m. to 8 p.m. Stowe Country Club, annual outing.

DETROIT—Panel Symposium, "Throw Away Carbide Tools." Panel composed of: Mr. Loach, vice president of Firth Loach Metals Co.; Charles F. Brigner, Jr., assistant engineer, Modco Tools; Walter Greenleaf, Newcomer Products Co.; Richard Thornton, general manufacturing manager, moderator; and H. Niffin, production manager, Ford Motor Co.

EAST TEXAS—June 13, 7:30 p.m.

ERIE—June 15, 10 a.m., Penelec Picnic Grove, Kearsarge; 11th annual picnic.

HAMILTON DISTRICT—June 20, Dundas Golf and Country Club. Annual Field Day. Supper 6 p.m.

KEYSTONE—June 17, Castle Restaurant. "How a Tool Engineer Should Spend His Leisure Time" by Reid Supplee, the president of Sunnyrest Lodge and Sunny Palms Lodge.

KOKOMO—June 23, Clearwater Park. Family picnic for members.

LITTLE RHODY—June 6, 7 p.m., Johnson's Hummocks. "A Brief Survey of Nuclear Power" by William Atkinson, chief machinery arrangements engineer, General Dynamics Corp.

LONG ISLAND—June 15, 10 a.m., tour of Brookhaven National Laboratories.

LOS ANGELES—June 13, 8 p.m., Scully's Restaurant. "Economics of Tooling and Manufacturing," illustrated with slides, Harry Conn, chief engineer, Scully-Jones & Co.

MERRIMACK VALLEY—June 6, 7 p.m., Andover Country Club, Ladies Night. Smorgasbord at 8 p.m. Dancing.

MISSISSIPPI—June 3, 7 p.m., Walthall Hotel, Jackson. "Diamonds and Diamond Tools" by Peter Lunzer, vice president, American Coldset Co.

NASHVILLE—June 8, 5 p.m., Lester's Lake. Annual picnic.

NEW HAVEN—June 8, 1:30 p.m., picnic at Frank W. Gilbert's country place, River Road, Mt. Carmel. Sports and barbecue. Trip to old copper mine. If it rains, the picnic will be held on June 15.

NORTH TEXAS—June 14, 6:45 p.m., Amon Carter International Airport. "Production Planning—Past, Present and Future," E. R. Howell, supervisor of production planning, Chance Vought Aircraft, Inc.

OKLAHOMA CITY—June 4, 6:30 p.m., Clayton Fun Town. Family dinner at Uptown Cafeteria; technical film.

PHILADELPHIA—June 1, 12 noon, Philadelphia Rifle Club. Annual June outing. Dancing, show, games.

PHOENIX—June 10, Westward-Ho Hotel. "Automation by Numerical Control" by Donald M. Laflin, Giddings & Lewis Machine Tool Co. Also film.

PORTLAND, ORE.—June 22. Golf outing at Broadmoor Golf Course. Fifteen-stroke handicap, with prizes for all winners, member or guest.

RACINE—June 7, 12 noon, Kenosha Country Club. Annual spring frolic. Dinner 7 p.m.

ROCHESTER—June 3, 8 p.m., Barnard's Exempt Club. "Operation Push Button" by Lester Boese, regional manager, The Bellows Co.

ROCKFORD—June 14, 12 noon, Forest Hills Country Club. Golf stag, games and dinner.

SAGINAW VALLEY—June 15, Rolling Greens Golf Club. Golf outing and dinner.

ST. LOUIS—June 6, Ladies Night; June 29, annual stag picnic, Kohler Acres.

SAN GABRIEL VALLEY—June 6, 8:30 p.m., Rainbow Angling Club, Azusa. "Economics of Tooling and Manufacturing" by Harry Conn, chief engineer, Scully-Jones & Co.

SANTA CLARA VALLEY—June 18, 7 p.m., Old Plantation Inn, Los Altos. "Tools and Dies as Part of the Schlage Story" by Louis A. Talamini, design and methods engineer, Schlage Lock Co.

SYDNEY, AUSTRALIA—July 10, "Production of Australian Sheet Steels—Their Properties and Uses in Production" by Noel Frazer, chief metallurgist, Commonwealth Rolling Mills. About two weeks later a chapter visit to Port Kembla Rolling Mills.

TRI-CITIES—June 8, 8 a.m., Springbrook Country Club. Annual stag picnic and banquet at 6:30 p.m. Games, prizes, golf, contests.

TUCSON—June 11, "Automation by Numerical Control" by J. Daugherty, Giddings & Lewis Machine Tool Co.

WICHITA—June 12, 6:30 p.m., Midwest Industries plant tour.

WORCESTER—June 8, Leicester Country Club. Annual outing; golf and other games.

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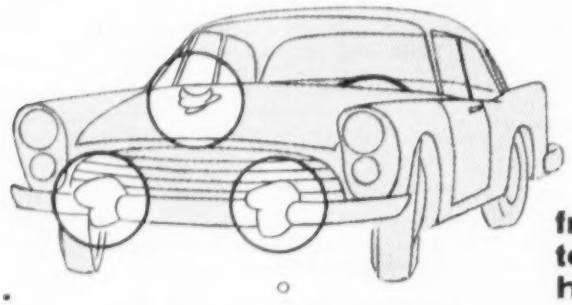
The jobs where tap life can be increased a hundredfold are obviously exceptional, but it *can* happen, as these cases prove, even in the cost-wise automobile industry. That's why it pays to question tap costs on any job. Job analysis by HY-PRO specialists *regularly* leads to savings as high as 50% — with special taps when required — but often with a simple switch to the right style of standard taps. Why not find out if your tap costs are low as they can be? It costs nothing to consult the HY-PRO specialists.



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The standard spiral point tap formerly used for tapping an automobile bumper bracket lasted for 100 holes or less, due to breakage. The cause was misalignment which could not be corrected without prohibitive expense for jigs, and for special controls in preceding operations. HY-PRO specialists designed a no-flute, 3-spiral groove tap with special heat-treatment which boosted production to 10,000 holes per tap — with no change in job conditions. Result . . .

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In a tapping operation on a die cast automobile ornament, the standard 3-flute tap being used broke after an average run of 25 holes. The cause was spalling and binding of the relatively soft alloy around the tap. HY-PRO specialists recommended an oversize 3-flute plug point tap with minor flute modifications. Binding was eliminated, and clean cut threads permitted easier assembly. Production was increased to 10,000 holes per tap. Result . . .

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PROGRESS IN PRODUCTION

TAPE CONTROL REACHES PRODUCTION

Demonstrations and production tests are now under way on a series of tape-controlled milling machines for the aircraft industry. The first of these machines, using Bendix Aviation Corp.'s system of programming and punched-tape control, is slated for Glenn L. Martin Co.'s Baltimore Div. According to Martin officials, it is expected to be in operation on airframe parts for the P6M SeaMaster jet seaplane and the TM-61 Matador early this fall.

The profile mill is a 50-ton Kearney & Trecker three-axis machine with a horizontal spindle. It was specially designed for tape-control operation. Substantial reduction in lead time in production of many machined parts is expected to result. C. T. Willey, vice president-manufacturing at Martin, said the new machine will eliminate many weeks of tool setup and tool change time, singling out these operations as "one of the most time-consuming processes in modern airframe manufacture."

Basic consideration in Martin's decision to invest in numerically controlled milling, Mr. Willey said, is the trend toward greater use of machined forgings, castings and extrusions in today's aircraft. Even at the present peacetime pace, he declared, the company's machine shop is working at capacity. On future designs he expects machining to increase manyfold. Moreaver, he states, tighter manufacturing tolerances will be needed for the higher strength airframes for tomorrow's supersonic aircraft.

Changes anticipated with numerically controlled machine tools will go all the way back to designers' drawing boards. Some design elements can be standardized and coded for storage in the system's memory unit, engineers taking part in this project indicate. It is expected that one result may be to reduce the amount of picture drawing required in design engineering.

The team needed to operate the new system consists of a tool engineer, flexo-

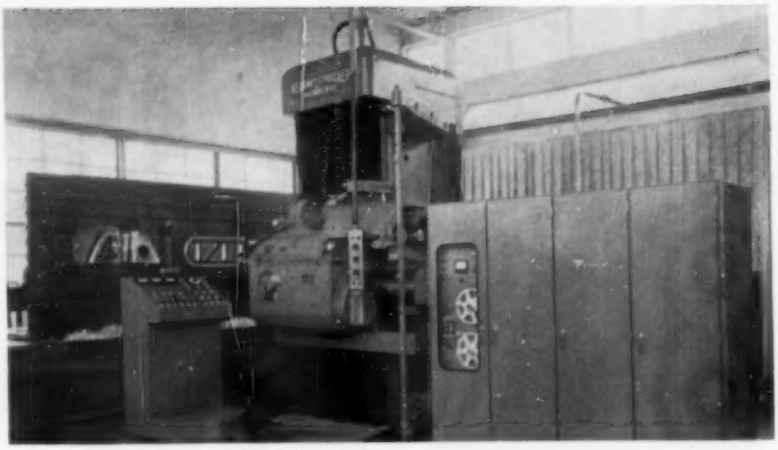
Tool engineer checks the master which is being converted by Flexowriter to code on tape which is then translated to the final control tape.

Operator loads tape on reels at the control panel. When placed on automatic operation, the milling machine will be directed from this panel.

Operator sets up tooling and engages cutter for the job. From this point work can be manually controlled or can be operated automatically by tape.

writer operator, computer operator and the machine operator in the shop. As shown in the acompanying photos, the tool engineer sets up or programs the part by establishing key reference points and tooling data. The flexowriter operator punches a paper tape, which is converted into a plastic control tape by the Bendix computer unit. The milling machine operator is merely required to set up the part for cutting, load and unload the control tape and make cutter changes.

According to Dr. Albert Hall, general manager of Bendix Research Laboratories, which developed this electronic programming and numerical machine control system, no special staff of mathematicians nor other experts are required. Self-checking features in the tape preparation system detect and correct any typographical errors in preparing the process tape. Other errors in the tape are dected by the machine control unit as it reads the tape and translates it into three-dimensional cutting operations.



Over-all view of setup using Bendix tape control. Table at far end holds workpieces; console contains dials and buttons for manual or automatic initiation; panel at right houses tape for automatic control.

Besides advantages of tool storage savings and almost instantaneous transfer of tooling information anywhere in the country, at a preview demonstration, Malcolm Ferguson, president of Bendix Aviation Corp. emphasized the great flexibility of application of the system. "One use which involves immediate economies," he points out, "is the storing of a tool design in a length of tape instead of making a standby die—common practice against interruption of production schedules caused by an accident to an original die." One such case he cited involved a reserve die costing $125,000. "A few feet of punched tape would be substituted . . . with savings beyond our present ability to compute," he stated.

The K & T profile milling machine contains high-performance hydraulic servos for control. The three cutting motions of the machine are continuously monitored by feedback instruments capable of detecting a motion of as little as 0.0002 inch. Presumably that would be the practical limits of precision obtainable in production with this machine. Sensitive control of positioning and machine feeds is achieved effortlessly by means of dials and push-buttons instead of the usual handwheels. Precision gaging is incorporated in the machine to permit replacement of worn tools without loss of accuracy between cutter and workpiece.

It is understood that these are the first large-scale automated milling machines to be ordered directly by industry. According to reliable advice, more than 20 of the K & T machines with the Bendix tape-control system are on order for various aircraft firms.

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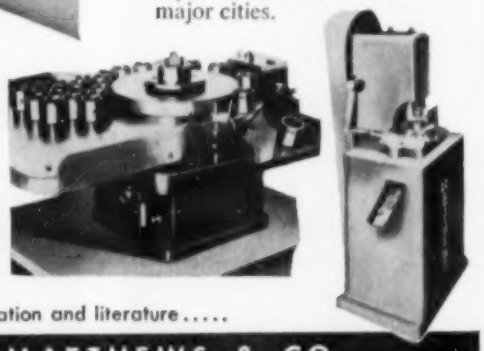

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CLAD WEAR PLATES PROVIDE ECONOMY

To meet the needs of automobile manufacturers for an economical aluminum bronze wear plate for dies with cam or sliding action, The Ohio Knife Co. has developed a cladding process which bonds aluminum bronze to a steel base. Savings are as much as 40 percent, as compared to the cost of solid bronze wear plates. The steel base is easily machinable for fitting to dies. Drilling or counterboring through the bronze surface presents no problem.

Aluminum bronze wear plates can be made to specification or delivered completely finished from stock. Plates are ground to ± 0.0005 parallel and flat. In addition to the original lower cost of the aluminum bronze wear plates, savings can also be realized because the fine quality bearing surface provides unusually long wearing qualities.

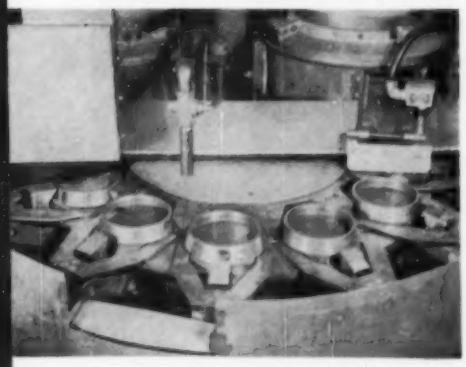
FAST OUTPUT WITH AUTOMATIC GRINDING SETUP

Automatic features built into modern surface grinding machines are providing an automatic transmission plant with the means of turning out 385 finish machined clutch cones per hour. In the entire setup, only loading of work into the machine is performed manually. All other functions, including unloading of the finished work, are designed into the machine—a No. 24-A2 rotary automatic surface grinder built by Mattison Machine Works. When the clamping finger moves forward and holds the part against a notch on the inner ring of the worktable, the part is positioned and clamped for grinding.

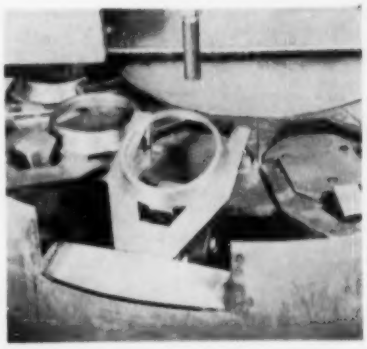
Typical of the unit's automatic safeguards is the electrically operated switch on the grinding wheel; it shuts down the machine if a part is clamped improperly. Thus there is no danger that a part will damage either the grinding wheel or itself even if it has been improperly placed initially.

Stock removal is 0.010 to 0.015 inch on one side in a single pass through the machine. Automatic sizing is provided at both the roughing and finish-

Fully loaded table of automatic transmission clutch cones being machined on the Mattison No. 24-A2 rotary surface grinder. Table rotates counterclockwise. Improperly positioned workpiece is prevented from passing under the grinding wheel by guard at right.



Unloading of finish machine clutch cone shows relative simplicity of unloading device used in the operation.

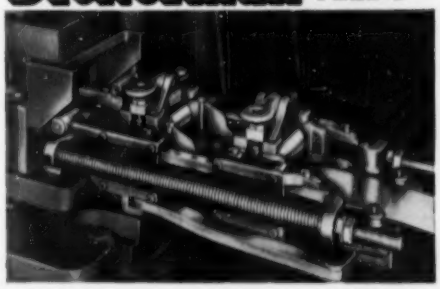


THE BOSS... gains through automation—overall production economy that means more work per day, per dollar.

8 ways to benefit... save... with

Dickerman FEEDS

PRESS ROOM FOREMAN... benefits by speed—Dickerman feeds operate continuously at any speed the tooling in the press will withstand.



PRESS OPERATOR... welcomes simplified operation—Dickerman feeds prevent human fatigue, human error, work indefinitely without downtime.

QUALITY CONTROL MEN... cheer the constant accuracy and uniformity Dickerman feeds bring to any press feeding job.

ASSEMBLY FOREMAN... gains as components flow in steadily—there's never an afternoon letdown, never a production lag.

THE CUSTOMER... is always ahead because deliveries are always on time, always "as specified".

DIE DESIGNERS praise the Dickerman templates that help them engineer Dickerman feeds onto their presses—send for your copies today!

You'll benefit through increased production . . . greater accuracy . . . bigger profits when you install dependable Dickerman Die Feeds, Hitch Feeds®, and Rol-Di-Feeds on your presses.

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Send today for complete details on the money-making Dickerman line

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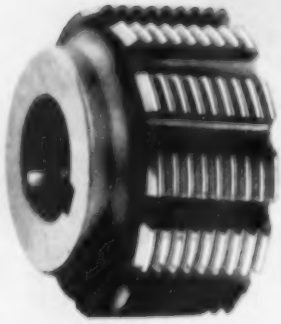

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THE
STANDARD

Your production requirements demand this standard—Hanson-Whitney's exclusive *finished-after-hardening* process. This assures extremely close limits in tooth spacing, form and relief for the entire line of multiple thread milling cutters. H-W ground form cutters provide minimum outside diameter run-out . . . do not restrict length of thread to be milled and maintain tolerances of parallelism or desired taper.

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Hanson-Whitney alone offers single source product integrity in machine tools, cutting tools, and precision gages. Consult H-W complete home and field engineering service on all threading problems. Local H-W distributors, with complete stocks—keep your production at peak levels. Write for complete literature.

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TAPS : THREAD GAGES : HOBS : CENTERING MACHINES : THREAD MILLING MACHINES AND CUTTERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-152

ing wheels. Additional limit switch protection is built into the machine so that the automatic sizer ceases to function when the useful limit of the wheel is reached. A red light then flashes to warn the operator that it is time to change wheels.

Work is unloaded automatically after it has passed under the finishing head. A cam releases the part-holding clamp and the fork located below the part-holding fixture tilts to slide the finished part into the exit chute.

DEVELOP PROCESS FOR SPINNING TITANIUM

Hot spinning of thick titanium alloy hemispheres has been successfully accomplished by methods suitable for economic production quantities. Both the process and the special machines to do the job were developed by Titanium Fabricators, Inc., as part of a research and development contract from Convair Div. of General Dynamics Corp. Included in the contract was development of suitable production techniques for forming, heat treating and welding 6 Al 4V titanium alloy pressure vessels.

The spinning machine developed for the work is a horizontal type allowing forming at controlled speeds and pressures. It was designed by Dr. Morris Asimow, director of engineering, to be completely hydraulic with an electrically driven table.

First use of the spinning process is in production forming of titanium alloy hemispheres with 15 to 25-in. diameter and with gage thicknesses in excess of ¼ in. using inexpensive dies. The hemispheres are then welded, forming spherical pressure vessels that can be used to store gases.

FORD STERLING PLANT SHOWS ADVANCED PROCESSES

A cornerstone in Ford Motor Co.'s multibillion dollar expansion program is the Sterling Plant at 17 Mile and Mound Roads, in the Detroit area. Production began there only last September. While facilities are still not entirely complete, according to Executive Vice-President Del Harder, the plant with some 3500 pieces of production equipment can turn out 11,000 axles per day and up to 66,000 differential gears, in addition to large quantities of other chassis parts for Ford assembly plants throughout the country.

This plant could well serve as a text on advanced production techniques, especially for materials handling, quality control, preventive maintenance and small parts automation. Employing some 6300 workers, this new manufac-

Over-all view of chassis parts plant where precision cutting of pinion gears is performed on automatic equipment.

turing unit was designed to utilize the most modern concepts in machine accessibility, and worker safety and comfort. Harder indicated that automatic processes embodied here reflect the company's progress in meeting competition, rather than any attempt to hold down employment. R. J. Hampson, general manager of Chassis Parts Div., stated that employment in the new plant is about 1000 higher than at the former location it replaces. The rise in employment is attributed to improvements in design and materials, greater attention to quality control, etc.

Outstanding facilities include several transfer machining departments, the world's largest gear-cutting department, automatic assembly of suspension components, automatically controlled heat treating and installations for inspecting and testing parts and assemblies. Manufacturing engineering has provided much unusual tooling, developed especially for these operations. In addition, this organization has worked closely with product design to assure that parts were designed or modified to suit the best production processes, according to John Dykstra, group vice-president.

He indicated in a recent press conference, when the plant was toured by members of business and technical press, that parts are already in production for the new Edsel car, which is reported set for introduction this summer.

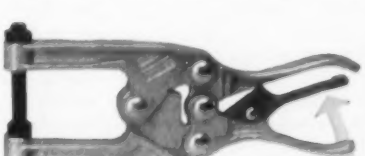
Open house for employees and their families was held on May 10th, when more than 20,000 people went through the building, according to John Swint, plant manager.

Rear axle housings are submerged into a water bath to test the welding of stamped, formed and rolled components in the assembly. Air bubbles detect any leaks. With modern transfer equipment there is no need for manual parts handling between operations.

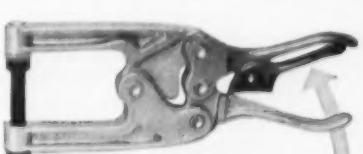
KNU-VISE
insta-release
PLIERS:

easy to open—quick to re-clamp

insta-release —that's the name for the easy-action release-lever Knu-Vise pliers. Pliers open instantly; re-clamp quickly—easily—without waste motion.



Maintains control over the free-swinging handle—permitting re-clamping with the same grip. Always remains within the hand span of the user.



Flip it over and you have instant release in the other direction. The Knu-Vise *insta-release* lever is available on P-1200 and P-1800 Series pliers.

Remember: Every model of the more than 150 ***Knu-Vise*** clamps is quick to lock—and quick to open. Ask for a demonstration.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

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WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

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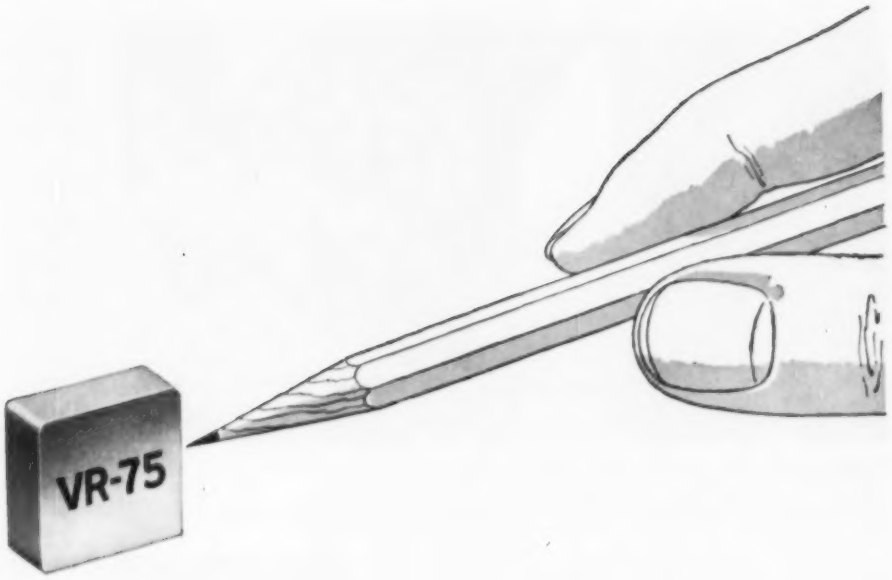


. . . a new Super Steel-Cutting Carbide Grade

field-proven on all types of work!

1½ to 2½ times greater tool life on crankshaft checking. Material SAE 1145 steel forging, 217-251 Brinell. Feed .013, SFPM 250. Toolholder with triangular full length insert. Severe interrupted cut.

Carbide	Insert life, average
Premium Grade "A"	125 pieces per corner
Premium Grade "B"	188 pieces per corner
VR-75	324 pieces per corner

81% greater tool life turning *Arma-steel forging,* 35-38 Rockwell C. Machine, Sundstrand automatic; feed .010; SFPM 400; depth of cut ⅛"—¼"; toolholder with triangular throw-away insert.

Carbide	Pieces Per Corner		
	Min.	Max.	Aver.
Premium Grade "B"	68	122	85
VR-75	115	211	160

Tool life doubled turning spline coupling. Machine, New Britain copy lathe; feed .020; speed 940 rpm; depth of cut 3/16". Negative rake toolholder with triangular throw-away insert.

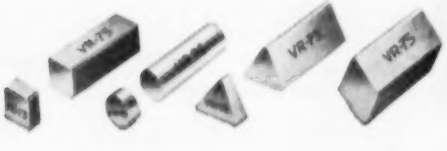
Carbide	Pieces per corner
Premium Grade "B"	120 average
VR-75	240 average

4 to 1 tool life turning spline end of axle shaft. Machine, Bullard Man-Au-Trol; material SAE 1330 steel, 340-360 Brinell; speed 290 sfpm; feed .0133. Toolholder with triangular long insert.

Carbide	Pieces per corner	Edge Wear
Premium Grade "A"	45	.050
VR-75	187	.040

AVAILABLE NOW in throw-away and long inserts for negative rake toolholders. Ask for Bulletin No. 572.

Call your V-R representative or distributor or write.



Vascoloy-Ramet Corporation

Subsidiary of Fansteel Metallurgical Corporation
842 S. Market St., Waukegan, Illinois

C-626

TOOLS *of today*

Vertical Chucking Lathe

Automatic vertical production lathe, called the Vertimax, is designed with cantilever support for both ends of the tool slides to provide maximum strength against cutting forces. Tool position is adjusted by means of calibrated eccentrics.

Although primarily intended for repetitive production runs, the Vertimax is economical for small quantities, as setup, change-over, and tool change are quick and simple. Tool slides, which can be operated simultaneously or in any sequence, can be swiveled from below horizontal to beyond the vertical position, making it possible to simultaneously machine two internal, two external, or an internal and an external taper. Calibrated eccentric adjustment enables setting to be made quickly and noted for future production runs.

The tool slides are cycled automatically by hydraulic controls which employ a differential feed system. Hydraulic locking makes them particularly suitable for interrupted cutting and other difficult machining operations. The differential system also senses unusual load conditions.

Automatic, rapid tool approach to cutting position and automatic tool relief for the return stroke are standard features. Depth of feed and slide travel are controlled by a mechanical, positive stop providing repeat accuracy; or optional automatic size control (compensation for tool wear) can be furnished by simple control substitution.

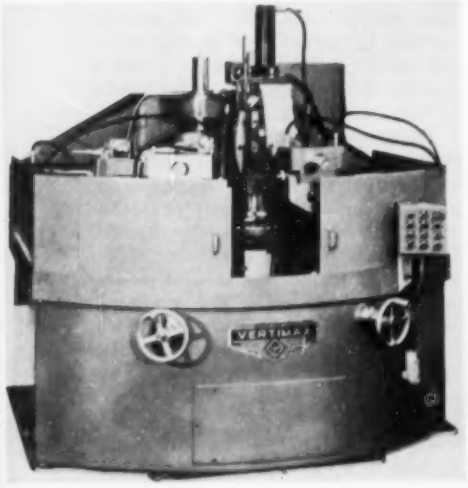
A full-length recess is provided along the entire length of three sides to accept standard 1 x 1-in. carbide toolholders, retractable boring bars, and rocking toolholders.

The main drive unit, consisting of motor, countershaft and spindle, is designed to handle heavy-duty, high-speed cutting.

Variable-speed motor with controls to maintain constant cutting speed at the cutting tool, desirable on large diameter work, is optional.

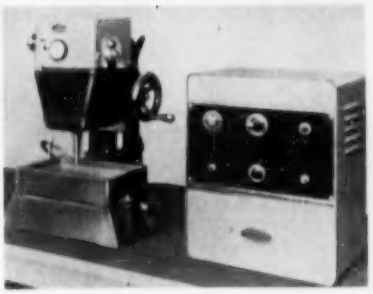
Cleveland Hobbing Machine Co., 1311 Chardon Rd., Cleveland 17, Ohio.

T-6-1



Ultrasonic Impact Grinder

Low-cost, high-precision ultrasonic impact grinder utilizes ultrasonic energy to drill, slice, trepan, engrave and shape hard and brittle materials with tolerances to ±0.0007 in. and finish to 8 microinches. Machinable areas cover a range from 0.002 to 1 in. diam. It may be used successfully on hard or soft steels, titanium carbide, tungsten carbide, ceramics and glass.



Construction features include hardened and ground steel ways, semisteel base and pedestal castings and a heavy gage steel-encased driver cabinet. Power source for the unit is 115 volts a-c, and water cooling is not required. The unit is bench-mounted. Size of pedestal and driver unit is 23 x 16 x 15 in. and the driver 19 x 16 x 13 in.

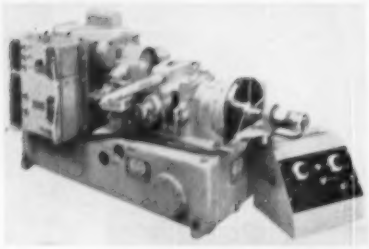
Commercial Equipment Div., Raytheon Mfg. Co., Waltham, Mass.

T-6-2

Servo-Controlled Drive

Precision speed control from zero to maximum rpm and positive follow-up position control from a remote command unit are possible with this electro-hydraulic servo-controlled drive. Two speed dials permit setting for two different speeds in one direction. They may be selected by a flip of the toggle switch on the command unit. Dials also may be set for any-speed in one direction and different speed in the opposite direction. Reversal is accomplished by a flip of the toggle switch. Manual adjustment of the dials results in stepless speed adjustment in either direction.

Immediate position control is accomplished by another toggle switch in the



command unit. Precise stopping positions can be dial selected in a 360-deg range.

A linear variable-differential transformer in the transmission produces an electrical signal proportional to slide block movement. If slide block voltage is not identical to command voltage, the servo valve spool is actuated and permits fluid to flow to or from the control cylinder to position the slide block. Any difference between the original signal from the command unit to the amplifier unit and from the transducer unit will result in repositioning of the slide block. Output speed will remain accurate from 0.1 to 1.5 percent.

The Oilgear Co., Servocontrol Div., Waltham, Mass. **T-6-3**

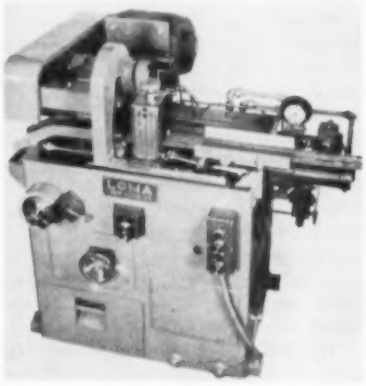
USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cutoff Saw

Automatic cutting to length of nonferrous tubes and rods is possible with this circular cutoff saw. Designed to maintain close length tolerances, the machine can handle a range of sizes from less than ¼ to 4-in. diam.

Swinging arm design causes an oscillating movement of the sawblade, resulting in a cutting action that facilitates multiple-strand sawing. As many as 10 tubes or rods can be cut simultaneously.

Up-and-down movement of the saw arm is effected by a combination oil-air system of cylinders. During feed stroke, oil is forced out of the hydraulic cylinder at controlled rate by an adjustable

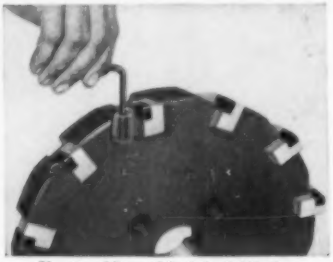


flow control valve. Feed rate can be selected to obtain best conditions for any cutting job, and avoids excessive loading of the sawblade. Return stroke of the saw is at a constant speed.

Double stock clamp contributes to minimizing burr. As soon as the stock has been advanced into the cutting position, the air operated clamping mechanism automatically moves vertically downwards, holding the material on either side of the blade. Clamps are lined with neoprene and clamping pressure is adjustable, to prevent risk of deforming delicate stock. Sawing cycle is automatically controlled and interlocked and is started by a single pushbutton.

The saw is designed to handle cutoff lengths up to 12 in. The sawblade

Cut Costs with McCROSKY shop proved money saving Jack-Lock® MILLING CUTTERS



Phantom View of Jack-Lock Wedge in Recess of Milling Cutter Body.

Get These Advantages

1) Blades locked rigidly.
2) Blades released quickly.
3) No drifts—no hammering.
4) Accurate adjustment against an indicator.
5) Reduced grinding time.
6) Minimum blade stock lost in re-grinding.
7) Longer blade life.

Featuring our nationally known shop proved Jack-Lock blade locking wedge, McCrosky Milling Cutters combine the rigidity of solid tools with the longer life, greater economy and lower cost of inserted blade design. Try McCrosky Milling Cutters. They are built to meet the speeds, feeds and power potential of modern milling machines. Face mills, shank and shell end mills, half side and staggered tooth designs. High speed, cast alloy or carbide tipped blades. Sizes from 3" to 24" in diameter. Write for a fully descriptive catalog today.

Shank Type End Mill

Shell End Mill

Staggered Tooth Milling Cutter

Also Face Mills; Half Side and Thin Slotting Cutters

The complete McCrosky line includes:

Jack-Lock® Milling Cutters — *Wizard*® Quick-Change Chucks
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McCROSKY TOOL CORPORATION
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operates at a peripheral speed of about 10,000 fpm, and oil-air mist lubrication can be applied when required by the cutting characteristics of the metal.

Loma Machine Mfg. Co., Inc., 114 E. 32nd St., New York 16, N.Y. **T-6-4**

Universal Indicator

Designed to save setup time while assuring accurate results, this universal indicator and holder has a 360 deg reading face that is visible in any position. No mirrors are required to obtain read-

ings. The entire mechanism is shock proof to assure continued accuracy in all readings.

The adjustable holder is easily positioned through the use of two thumbscrews. Three positions will permit readings up to 2, 5, or 15 in. diameters from any dead center line.

Oslund Precision Products, 14 Sigourney St., Hartford, Conn. **T-6-5**

Clamping Device

Automatic setup clamp, called PowRlick, can be installed on any standard machine, jig, or fixture to replace nuts and bolts. The basic unit consists of an air control, hydraulic booster, and one of three models of clamping heads. Compressed air from the factory system is passed through a filter-lubricator, to the on-off control valve. With the valve open, air enters the air-hydraulic booster, producting hydraulic pressure on the oil line. This hydraulic pressure acts on the PowRlock clamping heads, producing the locking force.

Boosters come in three sizes, and are capable of operating one, two, or four heads. Locking force is exerted by a 1½ in. piston, which moves through a maximum ½ in. power stroke. Travel ordinarily should be limited to approximately ⅛ in. Multiple point clamping can be achieved by using two or more

Improved Lusol..

A BETTER PRODUCTION METHOD

Improved Lusol, an oil-free transparent water-soluble solution, will give superior performance in a wide variety of grinding operations. The combination of lubricity and maximum cooling make Lusol especially indicated for Centerless Grinders where a fine low micro inch finish is required.

PROOF THAT LUSOL MEANS LOWER COSTS— BETTER RESULTS

THE WORK: Grinding seals for jet engines on Heald Rotary Grinder. **MATERIAL:** Chrome and S.A.E. 8740 Stainless Steel. **CUTTING SPEED:** 1800 R.P.M. **DILUTION:** Lusol 30-1, former coolant 20-1. **COST PER GALLON IN MACHINE:** Lusol 6½¢, former coolant 8¢. **PIECES PER DRESSING:** Lusol, 20; former coolant 15. And Lusol made possible a 5 micro finish which could not be achieved with the former coolant.

Lusol.. BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.

BOX 213, PORTLAND, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-157

interconnected boosters, with one air control.

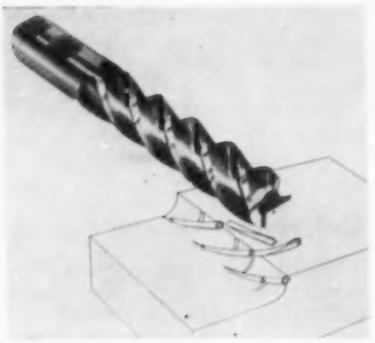
Wilton Tool Mfg. Co., Inc., 9525 Irving Park Rd., Schiller Park, Ill.

T-6-6

End Mill

This C-P end mill is designed for controlled penetration to provide accuracy and long life for cutting tough, hard-to-machine materials which have a tendency to deflect away from the work. Grooves or notches ground across the flutes of the end mill produce small ridges or lobes of material directly in the path of each tooth. These ridges apply pressure to the cutting edge, forcing it to take a uniform cut.

Because the grooves are staggered on the flutes, the lobes are removed by the succeeding tooth, thus producing a cut that has a smooth surface and good finish.



When the C-P mills are used to cut tough, stringy materials, chips are broken into small pieces that cannot build up in the tooth gullet to cause additional deflection and poor surface finish.

The mill is available in full range of sizes from ⅜ to 1½ in. in the long-flute type.

The DoAll Co., Des Plaines, Ill.

T-6-7

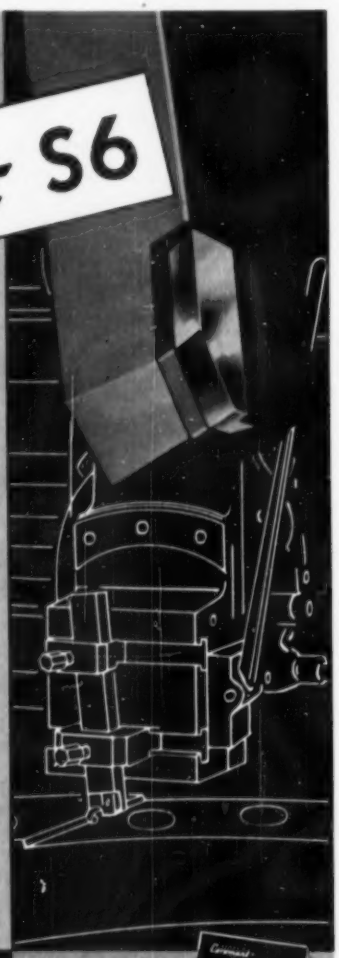
There's NO Equivalent—

Coromant S6

SANDVIK

To Coromant's

New Shock-Resistant CARBIDE Grade S-6



Sandvik Coromant's new S6 carbide is a unique combination of extreme toughness and high wear resistance. It's a super carbide that opens the door to lower machining costs on the toughest, tool-killing applications. These facts give it the ability to handle—

- planing, milling and turning operations on cast steel, heat resisting and stainless steels, scaly materials.
- interrupted cuts, feeds over 1/32".

Phone or write your nearest Sandvik Coromant office for further details.

88-132

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Send For This FREE CATALOG AND CARBIDE TOOLING GUIDE

Covers the complete Coromant line of carbide tools, blanks and inserts, tool holders, combination cutters, end mills, twist drills and scrapers. Also has many useful tables, diagrams, grade recommendations, etc. in technical data section.

FROM ORE TO FINISHED PRODUCT WITHIN THE SAME COMPANY

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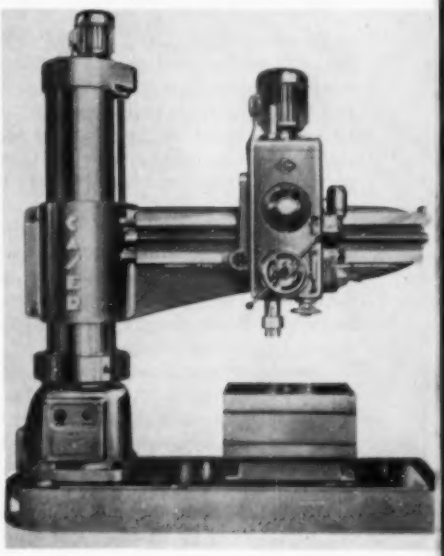
USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Radial Drill

Power arm elevation of the Caser Model F25 radial drill is controlled by a single lever which locks the arm when lever is in neutral position. Roller-mounted head on arm is hand controlled. A single control starts, stops and reverses the spindle. A direct reading dial provides means for presetting speed of the next operation while machine is running on one operation. The



feed dial can be turned to a new setting while the machine is running and the tool is engaged. Feed-selector dial has a built-in feed and speed chart.

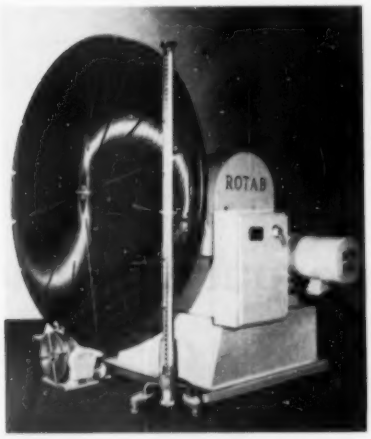
Model F25 has 2 ft 6-in. arm length and an 8-in. column. Drilling capacity in steel is 1 in.; in cast iron it is 1⅜ in. Spindle diameter at nose is 2⅜ in. Spindle travel is 8 in. Spindle with No. 3 Morse taper has 8 speeds ranging from 205 to 2300 rpm, and 3 feeds. Spindle motor is two speed: 1¾—2 hp.

Vertical travel of arm and column is 23⅜ in.; maximum distance from spindle nose to base, 46 in.; minimum distance spindle nose to base, 15⅝ in. Head travel on arm is 23 in. Maximum distance from column OD to spindle center is 30 in.

Distributed by Maserati Corp. of America, 662 Main St., Westbury, L. I., N. Y. **T-6-8**

Rotary Tables

Rotab tilting rotary tables, in sizes up to 84 in. in diameter, can be positioned to accuracies within 5 sec of arc as a result of optical measuring systems incorporated into their design. A micrometer microscope with glass vernier reticle permits direct reading for radial



A 12-in. hand-operated unit is compared with motor-driven 84-in. Rotab.

positioning on a graduated ring with clockwise and counterclockwise markings from 0 to 360 deg. The ring is rotated to the desired degree and locked into position to become a fixed part of the rotating table. Final precise radial adjustment can be made by a knurled handwheel. One revolution of this wheel equals approximately 0.2 of one degree, depending upon reducer ratio. A second vernier scale and optical system provides for full 90-deg angular settings, also within 5 seconds of true position. Provision also has been made for obtaining precise radial and angu-

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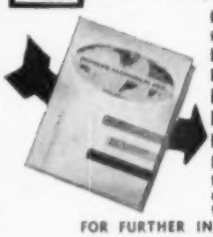

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lar settings by using sine bars and gage blocks.

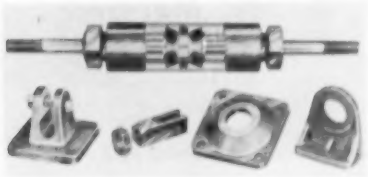
Two directional motor-powered rotating and tilting drive units provide operating efficiency. Fast, accurate positioning in any one of three dimensional planes is easily achieved and controlled through a portable pendant control box. The power drive mechanism can move the table from a vertical to horizontal plane in 35 sec and the table can be positively locked in whatever angular position is required for the operation to be performed.

A centering pin reference point and marking rings scribed in the face plate serve to facilitate parts positioning.

Machine Products Corp., 6771 E. McNichols, Detroit, Mich. **T-6-9**

Cylinders

Line of cylinders, identified as Type B, are available for air, water or hydraulic service in bores of 1½, 2½, 3 and 4 in., with either single-ended or double-ended rods. All sizes are available as double-acting or as single-acting spring-return cylinders. They have either brass or steel barrels, in



either case treated for corrosion resistance, stainless steel rods and Nylined bearings. Cushions are available for both ends.

Interchangeable foot, flange, and swivel mounts permit mounting in any manner or position. These compact cylinders are designed for ease of disassembly. Heads are fastened squarely and rigidly to the tube with commercial rectangular section, hardened-steel snap rings reground flat and parallel.

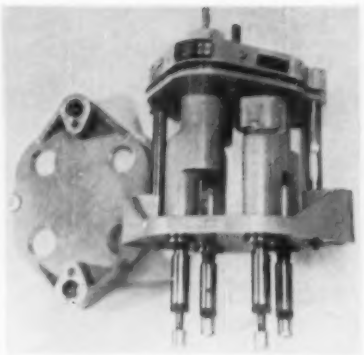
The A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N. Y. **T-6-10**

Multiple-Spindle Head

Multiple lead screw tapping of several parts with similar but varied hole patterns can be done with the use of this adjustable multiple spindle head.

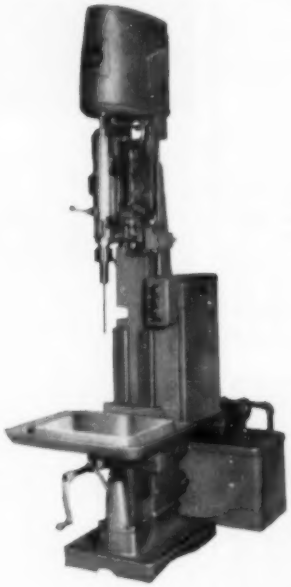
To make up this head, units of the standard line of double eccentric adjustable drillheads were fitted with lead screw spindles. Ordinary templates can be used to provide a quick means of accurately locating and locking spindles in position.

Normal spindle travel of 1½ in. is

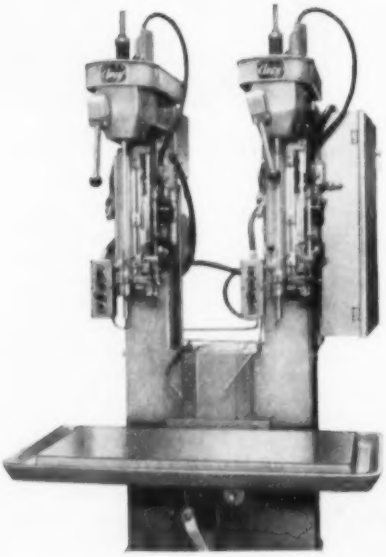


controlled by a rotary limit switch operated through a special shaft in this special head. A safety feature prevents damage to the head in the event of excessive spindle travel in either direction. Another feature built into the axial floating tap holders guards against damage resulting from the absence of previously drilled holes for the taps to enter. The illustration shows two holders completely retracted with the other two in the normal operating position.

Thriftmaster Products Corp., 1004B N. Plum St., Lancaster, Pa. **T-6-11**



Here's automatic push-button



Wire Stitcher

A box stitching method results from this machine in which stitches are cut and formed from a continuous coil of wire, driven into both outer and inner flaps of fiberboard boxes and clinched inside the inner flap without any mechanism entering the box.

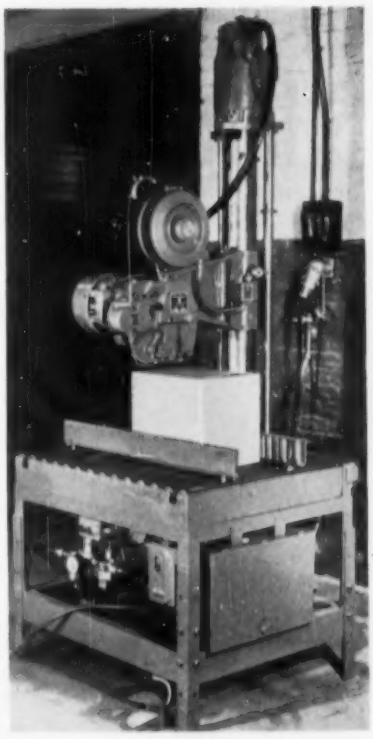
This method, called Circuate wire stitching, requires no retractable clinching anvils, thus production speed is increased while chances of product damage are minimized.

The stitching is performed by the N6 series box stitching machines with specially designed formers, shoes and wire arcing mechanisms, which made self-clinched stitches possible.

Flat stitching wire is drawn from a continuous coil mounted on the stitching machine, and an arc is formed in the cross section of the wire. The arc in the stitch provides both holding power and penetration strength.

Up to 700 average-size boxes can be stitched per hour. Approximately 13,000 stitches can be obtained from a 25-lb coil of flat stitching wire.

Model N6A17 (illustrated) with top



and bottom stitching units is designed to close simultaneously at high speeds the tops and bottoms of filled boxes with regular slotted or overlapping flaps.

It is easily integrated into conveyor line packaging systems. Each stitching unit or head drives 290 stitches per minute.

Other models in the N6 series handle more specialized functions. All models are powered by fractional horsepower electric motors enabling minimal power-requirements.

Acme Steel Co., 135th and Perry Aves., Chicago 27, Ill. **T-6-12**

Your drilling operations become fast, automatic, and simple when you have Avey-draulics in your shop. Almost immediately, you increase your productivity per man-hour.

The reasons are clear when you see these Avey-draulic features: (1) push-button control; (2) automatic cycle—rapid traverse, feed, and rapid return; (3) jump feed attachment available; (4) multi speeds; (5) variable hydraulic feeds; (6) 2" to 12" stroke; (7) 1 or 2 horsepower; (8) single or multiple spindle.

For automatic deep hole drilling, specify Avey's exclusive Torque-matic control. This automatically withdraws the drill for chip clearance—only when necessary—during your drilling operation.

For special applications, Avey-draulics can be mounted at any angle desired.

Write for Bulletin 252.

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AVEY DIVISION, THE MOTCH & MERRYWEATHER MACHINERY COMPANY, *Box 625, Cincinnati 1, Ohio*

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USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Long Bed Lathe

Designed especially for machining long work, this 16 in. x 14-ft. South Bend lathe takes up to 129 in. between centers. Swing over cross slide is 9⅝ in. or 11⅛ in. without chip guard, and maximum capacity over bedways is 16¼-in. diameter.

Sixteen spindle speeds range from 15 to 980 rpm. Motor and driving mechanism are enclosed in cabinet base under headstock. Spindle hole takes work up to 1⅜ in. and maximum collet capacity is 1 in. Spindle can be supplied with threaded, cam lock or long taper key drive nose. Quick change box pro-

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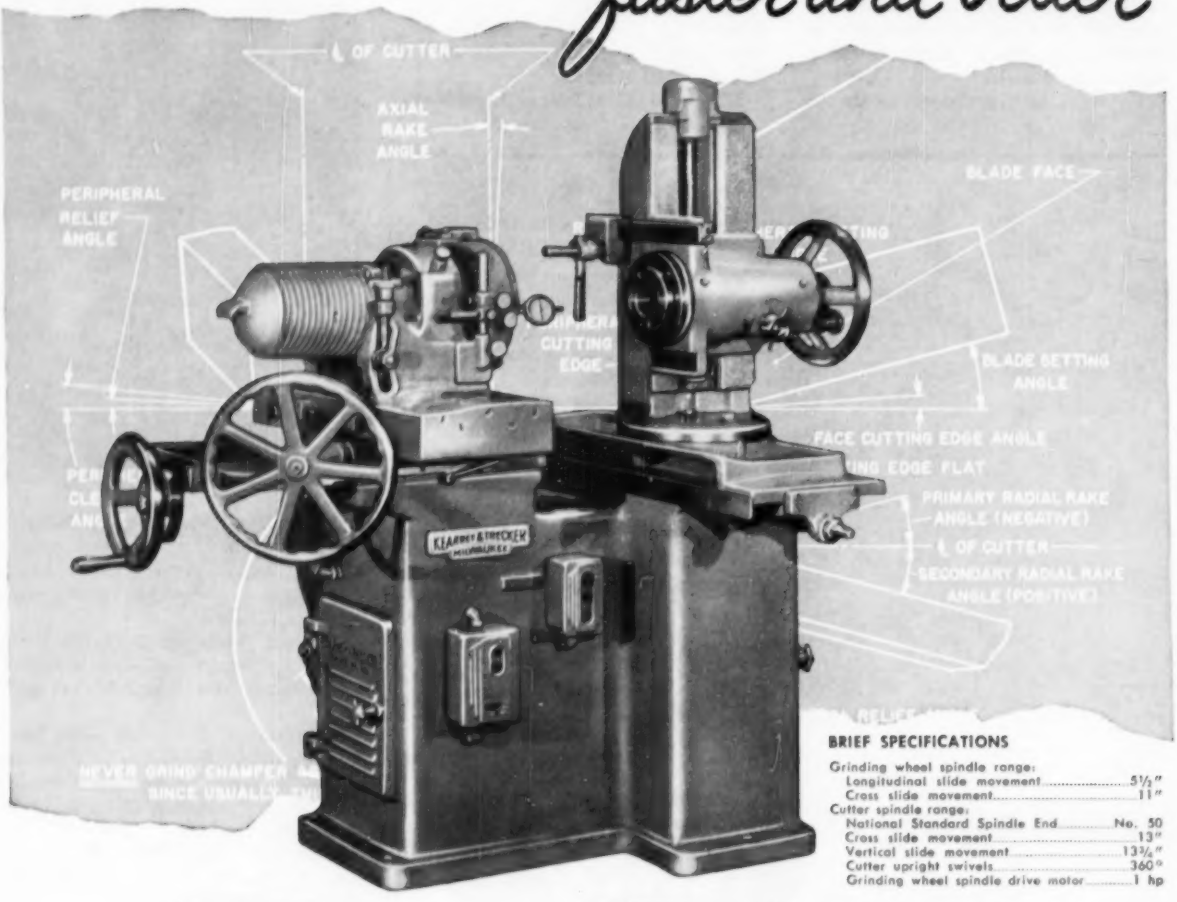
faster and better



BRIEF SPECIFICATIONS

Grinding wheel spindle range:	
Longitudinal slide movement	5½"
Cross slide movement	11"
Cutter spindle range:	
National Standard Spindle End	No. 50
Cross slide movement	13"
Vertical slide movement	13¾"
Cutter upright swivels	360°
Grinding wheel spindle drive motor	1 hp

KEARNEY & TRECKER MILWAUKEE

FACE MILL

CUTTER GRINDERS

handle all types of face mill cutters up to 24" in diameter. Accurate to 0.0002"

EVERY important feature you need for low-cost, efficient sharpening of carbide and H.S.S. face mill cutters are built into these Kearney & Trecker heavy-duty precision Cutter Grinders.

Handily located controls simplify operation. Graduated dials facilitate setups. Spindle flywheel helps maintain 3400 rpm constant speed during grinding. A jeweled-bearing dial indicator is furnished for checking finished cutter accuracy.

Three-inch to 7" dia. face mills attach to style "C" arbors and mount on the cutter spindle head. Cutters 8" to 24" dia. bolt directly to spindle nose.

Write for Bulletin G-10, Kearney & Trecker Corp., 6772 W. National Avenue, Milwaukee 14, Wisconsin.

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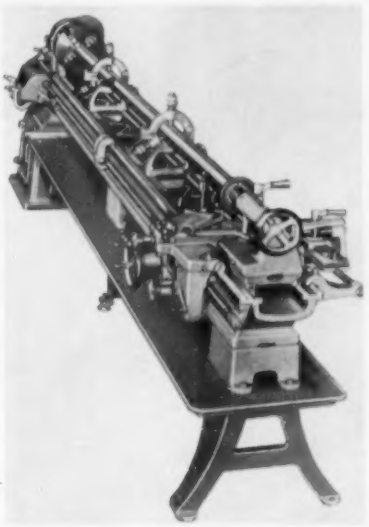
vides 48 thread cutting feeds, 48 power longitudinal carriage feeds and 48 power cross-feeds.

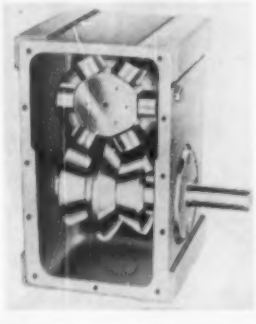
Accessories available for use with this lathe include pipe centers, steady rest, follower rest, taper attachment, external and internal grinding attachments, collet equipment, coolant reservoir and pump, turret tool block, pneumatic bar feed, milling and keyway cutting attachment and complete line of chucks and tools.



South Bend Lathe Works, South Bend 22, Ind. **T-6-13**

Roller Gear Drives

This E series of small, fast roller gear drives for precision indexing is rated for 2000 indexes a minute to a precision of 0.001 in. and zero backlash without auxiliary locking or locating methods.



Components of the mechanism consist of a precision-cut, hardened tool steel cam with a tapered rib and hub with standard bearing followers. The units are rated for a minimum of 8000 hours precision operation and employ a modified trapezoid acceleration characteristic for smooth, vibration-free indexing.

The standard E series drives are available from stock with 3, 4, 6, 8 and 12 stops and with indexing periods of 120, 180 and 270 deg. Housings are as small as 6⅜ x 4 x 4 in.

Ferguson Machine Corp. of Indiana, Roller Gear Div., P. O. Box 5841, St. Louis 21, Mo. **T-6-14**

Parallel Lapping Machine

Designed for quick setup and ease of operation, this lapping machine produces flat, parallel surfaces in production quantities with finishes to 0.09 micro-inch and dimensions held to one millionth of an inch. Suitable lapping fluids or pastes, work holders and monochromatic light inspection equipment are available.

As a supplement to grinding, the machine is practical for small parts which are difficult to hold on a magnetic chuck or on centers for grinding. It also may be used on thin parts that are difficult to grind without warping or damage, or on magnetic work which requires elaborate fixturing or cement or wax-holding methods.

Adjustable speed drive assures optimum rate for each phase in the lapping operation. The drive provides infinitely adjustable speeds of from 10 to 50 rpm of either the lower lap or the work holder in both directions. Speed is shown on the tachometer in the column of the machine.

The lower lap is stationary with the work holder rotating for most flat lapping. For cylindrical lapping and conditioning the laps the lower lap can be rotated. The laps are special stabilized alloy iron 16-in. diameter with

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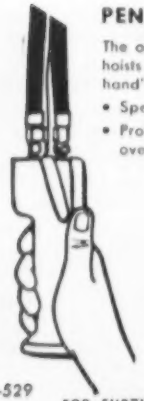
Move it anywhere . . . hang it anywhere . . . the I-R AIR-BLOC gives you versatility you never thought possible for speedy handling of loads up to 1000 pounds. No mechanical brake to fail . . . load can't drop even if air pressure fails. Responsive throttle control and automatic up-down-stop permit extremely accurate handling. There's a size just right for your job.

Portable winch-type Utility Hoists, in a wide range of sizes up to 4000 lbs., are also available from Ingersoll-Rand.



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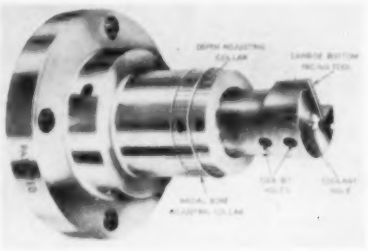
4-in. faces, either plain or serrated. Mineral laps are available for nonferrous materials. Capacity of the machine for flat work is 5 in. high by 5 in. wide by 5 in. long; for cylindrical lapping, 5-in. diameter by 5 in. long.

The DoAll Co., Des Plaines, Ill. **T-6-15**

Boring Head

Positive size bore and depth are combined in a boring head which allows adjusting the boring tool to a tolerance of 0.0001 in. without loosening or tightening any screws.

Depth adjustment facilitates setting tools to control bore depth or to compensate for tool wear in either single or



multiple spindle setups. The easy adjusting feature requires the machine operator to turn the calibrated adjusting collars with a spanner wrench.

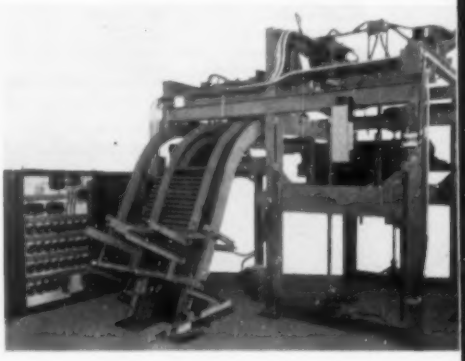
The whole boring head assembly is sealed against coolant and foreign particle infiltration and allows coolants to be applied to the work directly from the machine spindle through the boring bar.

Briney Mfg. Co., P. O. Box 2208, Pontiac, Mich. **T-6-16**

Automatic Stacker

This automatic stacking machine is designed to handle either tubes or bars from a cut-off machine, and stack them in a storage rack, ready for delivery to the assembly line.

Tubes or bars are handled automatically from the time they are released



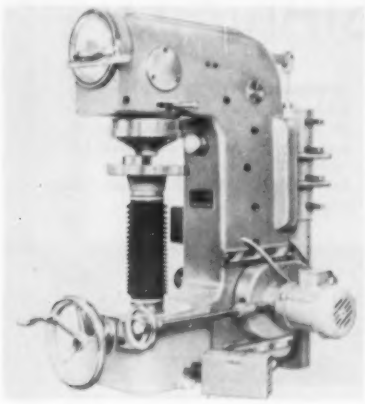
by the cutoff machine until they form a full magazine. At this point a mechanical drive assembly synchronizes action of an overhead transfer carriage and a lift table. An entire layer of tubes is lifted by a grab, transferred to storage rack on the lift table, and straightened. The overhead carriage returns to original position to await a magazine fill, and the cycles repeat.

Spurgeon Co., 23501 Hoover Rd., Van Dyke, Mich. **T-6-17**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hardness Tester

The Gries reflex hardness testing machine, with dead weight loads of 1 to 120 kg, incorporates an automatic load-selection system which permits the proper load to be imposed at the touch of a button. It also is possible to switch quickly to the correct magnetically-held indenter for a Vickers, Knoop, Grodzinski, or Micro-Brinell test. The unit incorporates a Carl Zeiss projection system, which enlarges the image of the indentation in the specimen from 70 to 140 times actual size. A metric scale mounted in front of the projection

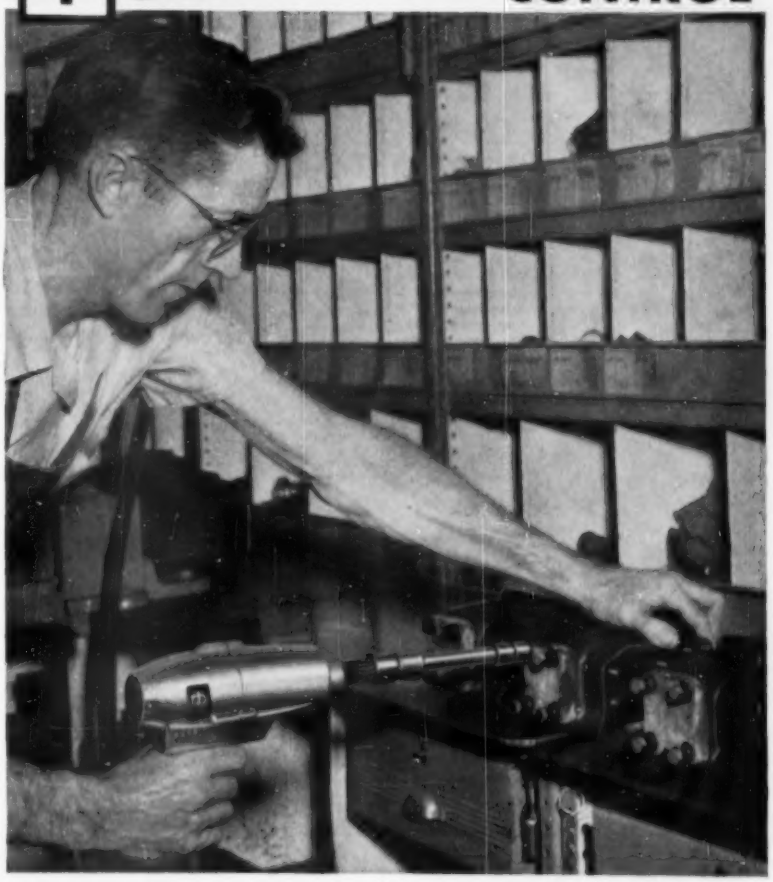


Reflex hardness tester.

screen gives visual measurement of the depth of indentation. Readings are converted into Brinell hardness in a table. In routing tests, adjustable limit stops are present and the operator can see whether penetration is of proper depth. In effect then the hardness tester becomes a go-not-go gage.

A second instrument, the microreflex hardness tester, is equipped with dead weights ranging from 10 g to 3 kg, and also uses the Carl Zeiss optical system and viewing microscope. Indentations can be magnified up to 500 times. This device may be used for Vickers, Knoop and Grodzinski tests on very thin specimens. The projected image is rotated

IR TORSION BAR TORQUE CONTROL



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2. **Scraper Assembly:** 6 line jobs using Impactools set for 40, 60, 75 and 80 ft. lbs. torques.
3. **Hydraulic control assembly:** 1 job running ½" cap screws to 65 ft. lbs. torque.

Production checks made by this manufacturer of road building equipment show that new Ingersoll-Rand Torsion-Bar Torque Control Impactools run every nut and cap screw within torque specifications.

With the standard impact wrenches previously used, the operators attempted to control torque by length of time the tool impacted. The new Torque Control Impactools shut off instantly and automatically when the pre-set torque is reached. This simplifies operator training and improves worker morale.

The end result is dependable product performance in the field. This same kind of cost-saving performance can be put to work for your company now. Write for Bulletin 5170.

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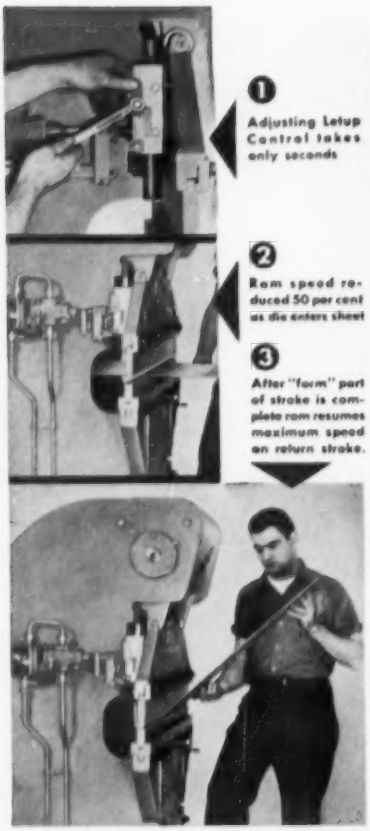

1
Adjusting Letup Control takes only seconds
2
Ram speed reduced 50 per cent as die enters sheet
3
After "form" part of stroke is complete ram resumes maximum speed on return stroke.

Letup Control on New High Speed

HYDRAULIC PRESS BRAKE

- *Eliminates whipping of material when forming*
- *Makes for fast, safe forming of large sheets*

An adjustable flow control valve is the basic element in the Letup Control, an accessory for all Di-Acro Hydra-Power Press Brakes.

Models with 3' and 4' bed and ram have Stroke Adjustment, speed from 32-80 strokes per minute, capacities of 16 and 18 gauge mild steel. These and other *features peculiar to hydraulic press brakes* spell out *Efficient, Safe* operation for a rapidly growing list of satisfied customers.

Consult the yellow pages of your telephone directory for the name of your nearest Di-Acro distributor or write us for press brake literature, prices and delivery.

pronounced die-ack-ro

di-acro PRECISION METALWORKING MACHINES

O'NEIL-IRWIN MFG. CO.

375 8th Ave., Lake City, Minn.

INDICATE A-6-166-1

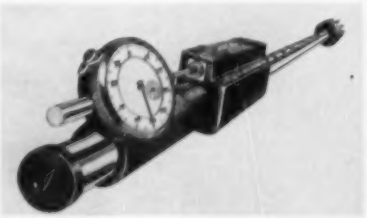
through 90 deg. for accuracy in measurement without disturbing the specimen. Measurements are made by a micrometer-adjusted system, which automatically superimposes the image on top of a projected calibration scale.

Testing Machines Div., Gries Industries, Inc., New Rochelle, N. Y.

T-6-18

Travel Control For Lathes

Designed for the accurate control of repeat machine operations, this micrometric travel control for engine and turret lathes permits fast, high quality machining to be done by a semiskilled



operator. Use of the tool, called Acra-Stop, reduces inspection time and lowers rejects.

With the Acra-Stop it is possible to set an engine lathe with up to 104 precision stops in a 15-in. run. Dial indicator on the tool measures accurate cutting to within 0.001 in.

Joslyn-Hudson Corp., Dept. 52, 2040 Colorado Ave., Santa Monica, Calif.

T-6-19

Comparator

This Dual-Aire Air-O-Limit comparator is designed for use at the machine on close-tolerance grinding or lapping operations and close-tolerance segregating. Two separate magnifications are provided simultaneously without switchover. This allows the operator to use the low magnification scale during prelim-

What other tool companies consider "SPECIALS" (IN DECIMAL SIZES) ...WE STOCK AS STANDARD

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INDICATE A-6-166-2

inary stages of his work, reading deviation from final size to 0.0001-in. increments. As finished size is approached, the operator can check on the high magnification scale and read part size directly to within a few millionths.

Pratt & Whitney Co., Inc., West Hartford 1, Conn. **T-6-20**

Tape-Controlled Positioning Table

Drill press has a tape-controlled automatic spacing table which provides positioning speed and sequence. It can proceed at a hole-to-hole speed of 150 ipm in any sequence and can go around a pattern of holes any number of times in any mixed sequence, including or omitting any of the holes. Where ambient temperatures are not highly variable, accuracy of 0.001 is assured. Repeatability is 0.0005 in.

Zero point for starting hole location can be placed anywhere on the table; consequently, the piece can be set up anywhere on the table. Because the control system has a manual dial input, it can be used for one-piece layout work without preparation of tape. Tape, when required for the machine, is prepared in an office and does not require use of the machine.

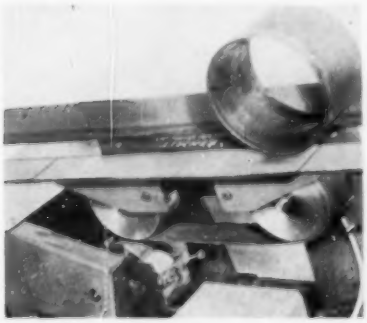
Operations to be performed on any given hole are noted on an instruction card on the operator's panel with an indicator light calling for specific instruction. All controls are mounted on the machine, and there is no separate console.

Jones & Lamson Machine Co., Springfield, Vt. **T-6-21**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Marking Equipment

The Roll-Over printer, designed to permanently mark free-rolling products as they are guided to roll over the inked marking die, is custom-made to fit into regular production line. As a part approaches the printer, its weight trips the printing unit mechanism to ink and position the marking die.



Either longitudinal or peripheral marking can be done. There is virtually no limit to printing surface or length of rolling product to be marked.

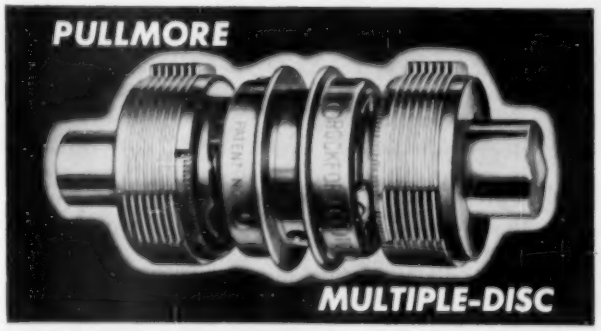
Because it is custom-made for each installation, the unit is adaptable to fit any production line requirements. Printing speed can be regulated to meet normal line output.

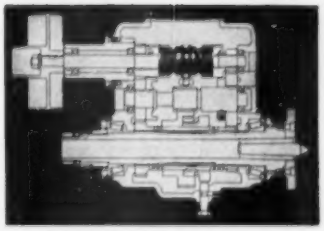
The Pannier Corp., 223 Sandusky St., Pittsburgh 12, Pa. **T-6-22**

Adjustable Speed Drive

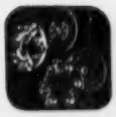
Electronic adjustable speed d-c drives are available in five sizes ranging from ¾ through 3 hp and provide electronic control of d-c motors from a-c power. Each provides a wide, smooth, stepless, adjustable speed range of 50 to 1, without field weakening, and speed from 35 to 1750 rpm. They provide full motor torque over the complete speed range. Motor speed will not vary more than ½ of 1 percent of full speed at any setting, when the load is varied

ROCKFORD





CLUTCHES (Single or Double) PROVIDE POSITIVE NEUTRAL


Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

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HIGH TORQUE
HIGH-RATIO LEVERS
POSITIVE NEUTRAL *
PRECISION BUILT
LONG WEAR LIFE
FAST ADJUSTMENT

* When the powerful engagement of PULLMORE Multiple-Disc CLUTCHES is released, declutching is instant and positive. The perfectly flat, floating discs separate and ride free—without drag, heat or abrasion. This positive neutral is especially valuable in rapid-operating, multiple-cycle machines.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

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ROCKFORD Clutch Division BORG-WARNER

1329 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales: Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

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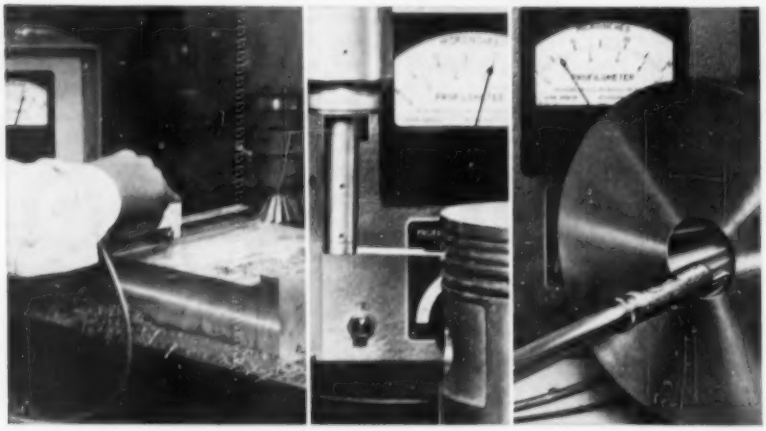
How to be SURE about Surface Roughness



NO NEED TO GUESS or wonder about the roughness of parts that you make or buy. With the PROFILOMETER® at hand, you KNOW the roughness, because —

1 The Profilometer *measures* surface roughness in definite *microinch units* (arithmetical or r.m.s. average height). It eliminates the errors and uncertainties of inspection by touch or sight.

2 It is *accurate* and *dependable*—even below 3 microinches. Cannot be set to give wrong readings.

3 It's a sturdy, portable SHOP TOOL — as easy to use as a dial gage.

4 It is *versatile*. Measures almost *any* surface, internal or external, over any desired length. Measures plastics, glass, etc. as readily as metal.

5 It's been *thoroughly proven* in thousands of production and inspection departments — *since 1936*.

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MMC MICROMETRICAL MANUFACTURING COMPANY

349 S. MAIN ST. ANN ARBOR, MICHIGAN

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from no load to full load, using a standard 240-v shunt-wound d-c motor.

The drives have been designed as compact units. The drive motor is also used as a tachometer and a standard motor with a single shaft extension can be used in the unit.

Drives are available as complete packages, consisting of an anode transformer, a control panel, a control station, and with or without a d-c shunt-wound drive motor. If furnished without the motor, a speed regulation of 2½ percent, rather than ½ of 1 percent, can normally be expected.

The anode transformer is designed to adapt the drive to either 220 or 440 v, single, phase, 50 or 60 cycle power. The transformers can be supplied for other standard alternating power sources.

The control panel provides for electronic use of the counter EMF of the

drive motor as a speed control signal, and the delivery of full wave rectified power to the motor to maintain constant motor speed regardless of ordinary load changes. This control panel is separately packaged, and can be installed anywhere.

The control station contains a single-dial speed adjustment knob and the push-buttons for the operator. Only this station and d-c shunt wound drive motor need to be placed at the machine.

Dynamic braking, quick slowdown, current limiting, jogging, reversing, and tandem operation of several motors from a common power panel and control station can be provided as optional features.

Weltronic Co., 19500 W. Eight Mile Rd., Detroit 19, Mich. **T-6-23**

Contour Mills

Hand-guided Hydro-Cycle contour mill, designed to handle a variety of jobs in big plant or small shop, is available as either a complete machine (illustrated) or as unit for "building block" erection.

Hand control of the tracer stylus attachment offers "feel" of the work so

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-6-219-1	Accurate Gear Works	Gear Racks—Pricelist R-1 gives data on stock gear racks. (Page 219)
A-6-197-1	Ace Drill Corp.	Carbide Drills—Catalog contains data on Ace "Ground from the Solid" drills and hardened H.S.S. drill blanks. (Page 197)
A-6-261	American Broach & Machine Div. Sundstrand Machine Tool Co.	Broaches—Information on practical broaching methods contained in Bulletin A175. (Pages 260-261)
A-6-249	Ampco Metal, Inc.	Special Metal—Ampco shell moldings described in Bulletin G-36. (Page 249)
A-6-161	Avey Division, Motch & Merryweather Machinery Co.	Drilling Machines—Bulletin 252 describes single and multiple operation drilling machines. (Pages 160-161)
A-6-313	Besly-Welles Corp.	Taps—Tap Catalog 801 describes standard and special taps. (Page 313)
A-6-298-3	Black Drill Co., Inc.	Cutting Tools—Hardsteel drills described in "Hardsteel" Operators Manual. (Page 298)
A-6-18	The Blanchard Machine Co.	Grinding Wheels—"Blanchard Abrasive Wheels and Segments" and "The Art of Blanchard Surface Grinding" now available. (Page 18)
A-6-199	Chicago Rivet & Machine Co.	Rivets—Catalog contains engineering data and rivet specifications. (Page 199)
A-6-269	The Cincinnati Milling Machine Co.	Induction Heating—New Inductron induction heating machine described in Bulletin No. M-1993. (Page 269)
A-6-255	Circular Tool Co., Inc.	Cutting Tools—Catalog O contains data on Circular metal-cutting saws. (Page 255)
A-6-272-4	Composite Forgings, Inc.	Die Sections—Composite die sections described in booklet "Engineering Data." (Page 272)
A-6-290-2	Comtor Co.	Dial Gages—Bulletin 50 describes Comtor plug precision internal gage. (Page 290)
A-6-290-3	J. Arthur Deakin & Son	Special Machines—Catalog D describes Alexander deep throat engraver and other British machines. (Page 290)
A-6-194-2	Devcon Corp.	Special Material—Booklet describes the four types of Devcon plastic steel. (Page 194)
A-6-41	DeVlieg Microbore Division	Special Tooling—Catalog 56 describes microbore tooling and methods. (Page 41)
A-6-263	Eastman Kodak Co.	Projectors—"Projection Gaging with Kodak Contour Projectors" describes Kodak simplification of measurement and inspection problems. (Page 263)
A-6-185A	Eclipse Counterbore Co.	Counterbores—Engineering data contained in Catalog No. 51. (Page 185)
A-6-185B	Eclipse Counterbore Co.	End Mills—Catalog No. 56 contains engineering specifications. (Page 185)
A-6-245	Abrasive Div. Elgin National Watch Co.	Cutting Tools—Catalog contains Elgin line of solid carbide end mills, drills, reamers and burs. (Page 245)
A-6-256	The Fellows Gear Shaper Co.	Gear Shapers—"The Art of Generating with a Reciprocating Tool" gives engineering details. (Page 256)
A-6-244	The Foote-Burt Co.	Broaching Machines—Circular No. 503 describes Foote-Burt surface broaching. (Page 244)
A-6-171-1	The Gaertner Scientific Corp.	Microscopes—Bulletin 161-54 shows applications, models and specifications for toolmakers' use. (Page 171)
A-6-250	Galland-Henning Nopak Div.	Cylinders—Catalog 105 describes Nopak-Matic plus valves. (Page 250)
A-6-225	Gardner-Denver Co.	Air Tools—Bulletins 12-101 and 16-301 describe new air driver for screwdriver or nut setting. (Pages 224-225)
A-6-29	Gisholt Machine Co.	Lathes—Form 1178 describes new Gisholt Masterline No. 12 Automatic Production Lathe. (Pages 28-29)
A-6-273	Greenlee Bros. & Co.	Automatics—Catalog A-405 contains information on Greenlee automatic bar machines. (Page 273)
A-6-59	Hannifin Corp.	Cylinders—Hannifin cylinder file contains data on lines of Hannifin cylinders. (Page 59)
A-6-5	Hardinge Bros., Inc.	Lathes—Bulletin HLV describes Hardinge toolroom and production lathe. (Page 5)

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A-6-55	Haynes Stellite Co.	**Cutting Alloys**—Metal-Cutting Tool Manual gives engineering data on Haynes Stellite alloy tools. (Page 55)
A-6-228-2	The High Standard Mfg. Corp.	**Drills**—Engineering File D gives data on deep-hole drills. (Page 228)
A-6-198	The B. Jahn Mfg. Co.	**Dies**—Catalog contains case histories and engineering specifications of B. Jahn dies. (Page 198)
A-6-162	Kearney & Trecker Corp.	**Grinders**—Bulletin G-10 describes K & T face mill cutter grinders. (Page 162)
A-6-242	Kennametal Inc.	**Cutting Tools**—Kendex Profiling Tools described in Booklet No. B-105. (Page 242)
A-6-211	Lamina Dies and Tools, Inc.	**Press Supplies**—Catalog contains information on guide pins and bushings for regular or special applications. (Page 211)
A-6-172	Lepel High Frequency Laboratories, Inc.	**Induction Heating**—Catalog contains data on Lepel induction heating applications. (Page 172)
A-6-312-2	Lovejoy Tool Co., Inc.	**Cutting Tools**—Catalog No. 31 contains data on face milling cutters. (Page 312)
A-6-188	Melin Tool Co., Inc.	**End Mills**—Tool Catalog No. 54-C lists the specifications on stub length tools. (Page 188)
A-6-43	Metallurgical Products Dept. General Electric Co.	**Cutting Tools**—Catalog GT-316 contains new grade selection guide for Carboloy cemented carbides. (Pages 42-13)
A-6-219-2	New Hermes Engraving Machine Corp.	**Material**—Booklet TG-1 describes new flexible, chipproof Gravoflex engraving stock. (Page 219)
A-6-272-1	Opto-Metric Tools, Inc.	**Comparator Charts**—Catalog No. 56 lists comparator charts by gage for any make optical comparator. (Page 272)
A-6-282	The Osborn Mfg. Co.	**Brushes**—Centerless brushing methods described in Catalog 210-C. (Page 282)
A-6-278-1	Pangborn Corp.	**Special Machines**—Pangborn Hydro-Finish described in Bulletin 1403. (Page 278)
A-6-295	Perry Equipment & Engineering Co.	**Machine Attachments**—Vibratory parts feeders described in Bulletin No. 635. (Page 295)
A-6-189	Reed Rolled Thread Die Co.	**Thread Rolling**—Attachment Application Booklet B-101 describes Reed Thread-rolling attachments. (Page 189)
A-6-274	Rivett, Inc.	**Valves**—Catalog 204 gives circuit design drawings, specifications, cutaway views, tables, diagrams of rivet valve with floating piston. (Page 274)
A-6-167	Rockford Clutch Div. Borg-Warner	**Clutches**—Bulletin shows typical installation of Rockford clutches and power take-offs. (Page 167)
A-6-248	The Rotor Tool Co.	**Air Tools**—Bulletin 56 gives engineering applications of Rotor vertical grinders. (Page 248)
A-6-207	The S-P Mfg. Corp.	**Power Chucks**—S-P Power chucks described in Catalog No. 105. (Page 207)
A-6-214-2	Standard Parts Co.	**Fixture Components**—Catalog describes jig and fixture components. (Page 214)
A-6-251	The L. S. Starrett Co.	**Instruments**—Catalog No. 27 describes and illustrates the complete Starrett line for precision measurement. (Page 251)
A-6-272-2	Thriftmaster Products Corp.	**Drillheads**—Catalog contains engineering specifications of thriftmaster drillheads. (Page 272)
A-6-216	Tomkins-Johnson Co.	**Cylinders**—Details of spacemaker line cylinders contained in bulletin SM56. (Page 216)
A-6-252	Uddeholm Co. of America, Inc.	**Tool Steels**—Uddeholm's Swedish tool steels listed in Tool Steel Stock list No. 12. (Page 252)
A-6-154	Vascoloy-Ramet Corp.	**Cutting Material**—Vr-75 steel-cutting carbide grade for throw-away and long inserts for negative rake toolholders described in Bulletin No. 572. (Page 154)
A-6-223	Whiteman & Barnes	**End Mills**—End Mill catalog introduces new Whitman & Barnes end mills. (Page 223)

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Here are reliable, easy-to-use microscopes for precise, indisputable measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. With these instruments you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear.

Through the engineering facilities at our Chicago plant, these versatile, well-constructed microscopes can be adapted to meet your exact needs. Find out now how you can gain new production savings with Gaertner measuring microscopes.

Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Scale Micrometer or Shop Microscope

High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

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The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.

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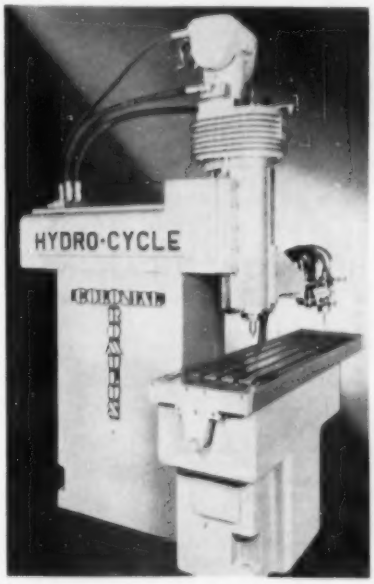
INDICATE A-6-171-1

that irregular contours can be cut without complex equipment. In die work there is no need for barbering operations. Tracer and template are offset for operator convenience and safety. Micrometer adjustments accurately control the relationship between master and workpiece. The tracer attachment can be furnished with single two or three-dimensional control.

Cross travel is 18 in., and vertical travel is 12 in. Standard longitudinal travel lengths available are 32, 42 and 48 in. Spindle speeds are infinitely adjustable from 40 to 3000 rpm. Full



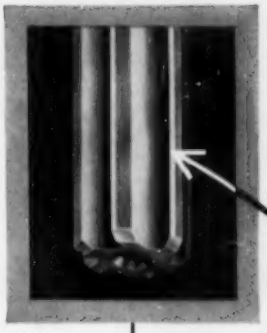
horsepower is available at all spindle speeds.

For "building block" erection, the Hydro-Cycle is offered as a complete contour milling unit for individual mounting or multiple setups on a common base. Fully equipped, the unit is basically the same as the complete machine but designed for lighter requirements and versatility. Cross travels range from 12 to 36 in. with vertical travel of 8 in. Longitudinal travel lengths are offered to suit the application.

Colonial-Romulus Div., Colonial Broach and Machine Co., Parkgrove Sta., Detroit 5, Mich. **T-6-24**

Metal-Cutting Band Saws

A line of "Job Tempered" metal-cutting band saws include both hard-edge standard steel and high-speed steel saws. Standard tooth shape is provided for cutting most ferrous and hard, nonferrous materials. Skip-tooth blades are furnished for cutting soft metals, wood, plywood, composition board and plas-



This edge cuts reaming costs

L+I gives you the edge on production

Call your L+I distributor

The Reamer Specialists

LAVALLEE & IDE, INC.

CHICOPEE, MASS.

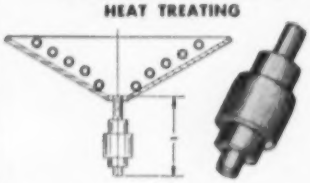
INDICATE A-6-171-2

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

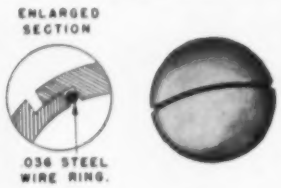
TYPICAL INDUCTION HEATING APPLICATIONS

TEMPERING FOR CUSTOM HEAT TREATING



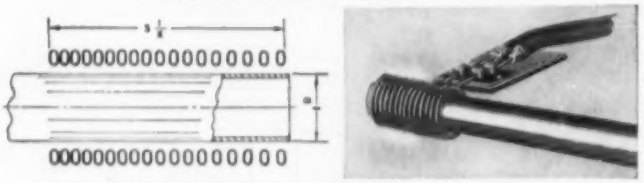
Selected areas of hardened steel parts may be tempered for fabrication or service requirements. Concentrator type coil permits high power density in restricted area thus minimizing heating time and permitting marked variation in properties in adjacent sections.

WIRE RING JOINS PLASTIC PARTS



High frequency induction heats wire ring which in turn heats plastic wall, providing sufficient plasticity to cause flow and bonding upon application of pressure. Metal to plastic seals are similarly performed.

ANNEALING ALUMINUM FURNITURE TUBING



Selective annealing of aluminum furniture tubing permits bending where required without loss of strength in adjacent portions of tube. Brass or steel tubing is also being selectively annealed.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

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55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-172

tics. Hook-tooth saws are designed for faster cutting, especially in gummy materials.

Blade widths range from ⅛ to 1 in. Standard-tooth blades are furnished with either regular or wavy-set teeth. Skip and hook-tooth blades are regular-set only. Saws are heat treated for hardness along the toothed edge only, thus providing maximum wear resis-

tance for the teeth, while leaving the remainder of the blade flexible to withstand constant bending over the wheels in operation.

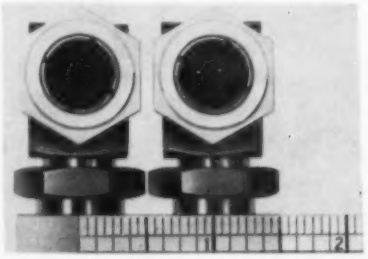
Heller Tool Co., Newscomertown, Ohio. **T-6-25**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Metal-to-Metal Seal

These straight-thread fittings are constructed to provide a positive, leak-proof seal through metal-to-metal contact.

Compact design saves space in multiple setups where several hydraulic lines must be concentrated and also makes possible the setting of high pressure



hydraulic fittings side-by-side on sub-panels.

The fittings can be attached or removed with ordinary tools, regardless of shape or style, since no swing radius is required.

Body of the fitting remains stationary, due to the special captive nut which floats on a smooth stem above its threads. This construction permits the nut to be lowered and tightened so that it coins its own seat.

There is no need for grinding or fin-

ishing the base or bosses to obtain a tight seal. No special tools are required, and no special finish of the normal seat is needed.

The metal-to-metal seal is available in sizes from ¼ to 2-in. OD, in all conventional shapes, in self-flaring, no-flare and flare type fittings.

Flodar Corp., 16911 St. Clair Ave., Cleveland 10, Ohio. **T-6-26**

Universal Sorting Machine

Sorting anything from bearing balls to gears and piston pins into as many as thirteen categories is possible on this compact, portable Autosorter. Design of the machine is based upon a no-drift electronic principle of gaging plus a simple mechanical memory system. The same machine can be used for increments anywhere from ten millionths to ten thousandths.

Accuracy between classes is as low as 0.000002 in. Speed range averages

around 10,000 pieces per hour, depending upon size and type of piece.

For changing to different types of workpieces, the top portion containing the mechanical feeding and positioning elements is removed and replaced in less than 10 minutes.

For visual inspection of balls and rollers, a stroboscopic light in a window indicates out-of-roundness.

EAM Div., Industrial Gauges Corp., West Englewood, N. J. **T-6-27**

Hydraulic Valve

A servo type hydraulic valve, identified as SerVan, provides repetitive, precise reversal of flow to work element, automatic cycling, hydraulic lock with assured equal opposing pressures, and no pressure or flow restriction.

The unit is self-energized by hydraulic circuit flow and is actuated by feedback control. Function is precise, and in case of mechanical or circuit malfunction, the valve will fail safe by shutting down before reaching the reversal point. Positive limit stops can be used because there is no problem of overtravel.

Signal reception demand is in ounces of force applied. Functions are based on metered incremental displacement of the hydraulic fluid, thus reversal action is not sensitive to pressure or flow variation. Accuracy of reversal remains uniform with pressure differentials from 5 to 2000 psi.

Deceleration-acceleration characteristics of reversal can be built in to meet application requirements and can be changed in use simply by substitution of actuation spools.

Vanguard Engineering, 51 Washington Ave., Cranston 7, R. I. **T-6-28**

Honing Machine For Ring Raceways

Both inner and outer raceways for ball bearings are honed on this line of multiple-spindle machines developed for automatic processing and handling of raceway rings.

The machines are designed with either 3 or 5 spindles, depending on the bearing size. Automatic operation includes loading and ejection, cycling, and feeding of the abrasives. The machine stops automatically when abrasives require replacing.

Tapered arbors are used for the small inner rings, and end-clamping arbors for larger sizes. Parts are pressed on the arbor and then pulled against a plate that locates them in

SUBLAND TOOLS—
(Standard and Special)

Reduce SET-UP TIME, Cut PRODUCTION COSTS

To produce more work in less time and at reduced costs, modern production methods often require multi-diameter tools that perform a combination of operations with each pass—drill-counterbore, drill-ream, drill-chamfer, etc. Your best bet for accomplishing these objectives are subland cutting tools, precision produced by Detroit Reamer & Tool Company.

A leading participant in the original development of subland tools more than 25 years ago, Detroit Reamer & Tool Company has been a major manufacturer of such tools ever since. Thus, our engineering experience combined with modern manufacturing facilities assure that you receive the finest quality subland cutting tools.

DR&T COMPANY

DETROIT REAMER & TOOL COMPANY

780 W. MAPLE RD. • P.O. BOX 174 • BIRMINGHAM, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-173

relation to the tools. Tools are mounted on an oscillating bridge that pivots about the true center of the raceway arc.

During the major portion of the timed cycle the bridge oscillates rapidly to give full coverage of the raceway and remove stock rapidly. The speed of oscillation is then automatically reduced, so that the finished track has all abrasive marks running circumferentially around the track.

Outer rings are held in chucks that

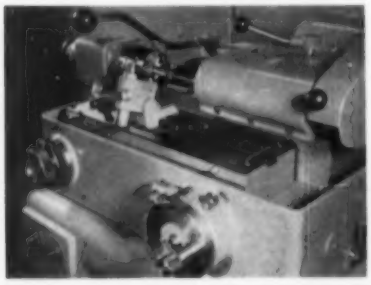
locate them from the OD and clamp on the side faces. The motions and cycling are the same as on the inner rings.

Production on a 5-spindle Microhoner, finishing No. 8 inner bearings, is 500 rings per hour. Using 3 spindles for the outer rings of the same bearing, production is 240 parts per hour. This production figure will vary with the size of the bearing and the condition of the rings as they come to the machines.

Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich. **T-6-29**

Cylindrical Grinder

Suitable for external and internal grinding of all types of components, the Overbeck precision cylindrical grinding



machines have a maximum grinding length of 4¾ in. Maximum length of the component which can be accommodated is 8⅝ in.

Bearings of the workhead spindle and grinding wheel spindles are adjustable and self-lubricating. The grinding table has longitudinal movement effected by a special drive which gives a uniform speed of stroke with accelerated reversal at the end of stroke. Length of stroke can be adjusted accurately from 0.004 to 4¾ in. Different speeds can be selected electrically for the grinding table and the workhead. Interchanging of high-duty grinding spindles suitable for external and internal grinding up to 120,000 rpm presents no problem.

Infeed of the grinding wheel is automatic and is adjustable from 0.00002 in. per stroke or double stroke. This mechanism is free of play and can be set accurately to within 0.00002 in.

Automatic fine-adjustment cross-feed has an adjustable stop for finish sizing. There is electromechanic control of work spindle, longitudinal travel, and cross-feed speeds.

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y. **T-6-30**

Air-Powered Lock Hammer

Any sheet metal locking edge can be turned in seconds by this air-powered Pittsburgh lock hammer.

Work, done in one pass, is fast, clean, smooth, and without dents. The portable

hammer easily handles 30 to 24-ga sheet metal. It also is available for heavier gages.

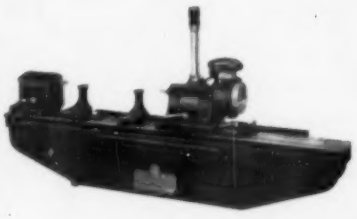
Modern Mfg. Co., Willow Grove, Pa. **T-6-31**

Toolroom Shaper

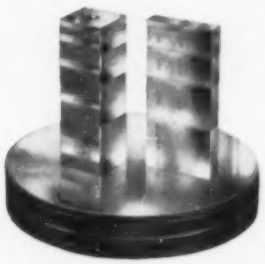
Universal toolroom shaper, identified as H-20, facilitates precision machining of either surfaces or profiles. A pole-changing flange motor allows shaping to be done either with a draw or conventional cut.

Working range of the tool is 8 x 11⅞ in. Accuracies of ±0.00025 area are assured within the working limits of the machine. By simple switch control the strokes can be changed to either 60 or

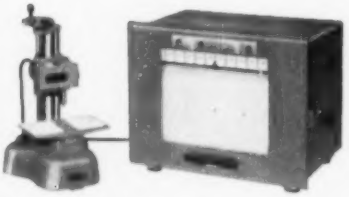
Basic Equipment for Higher Precision



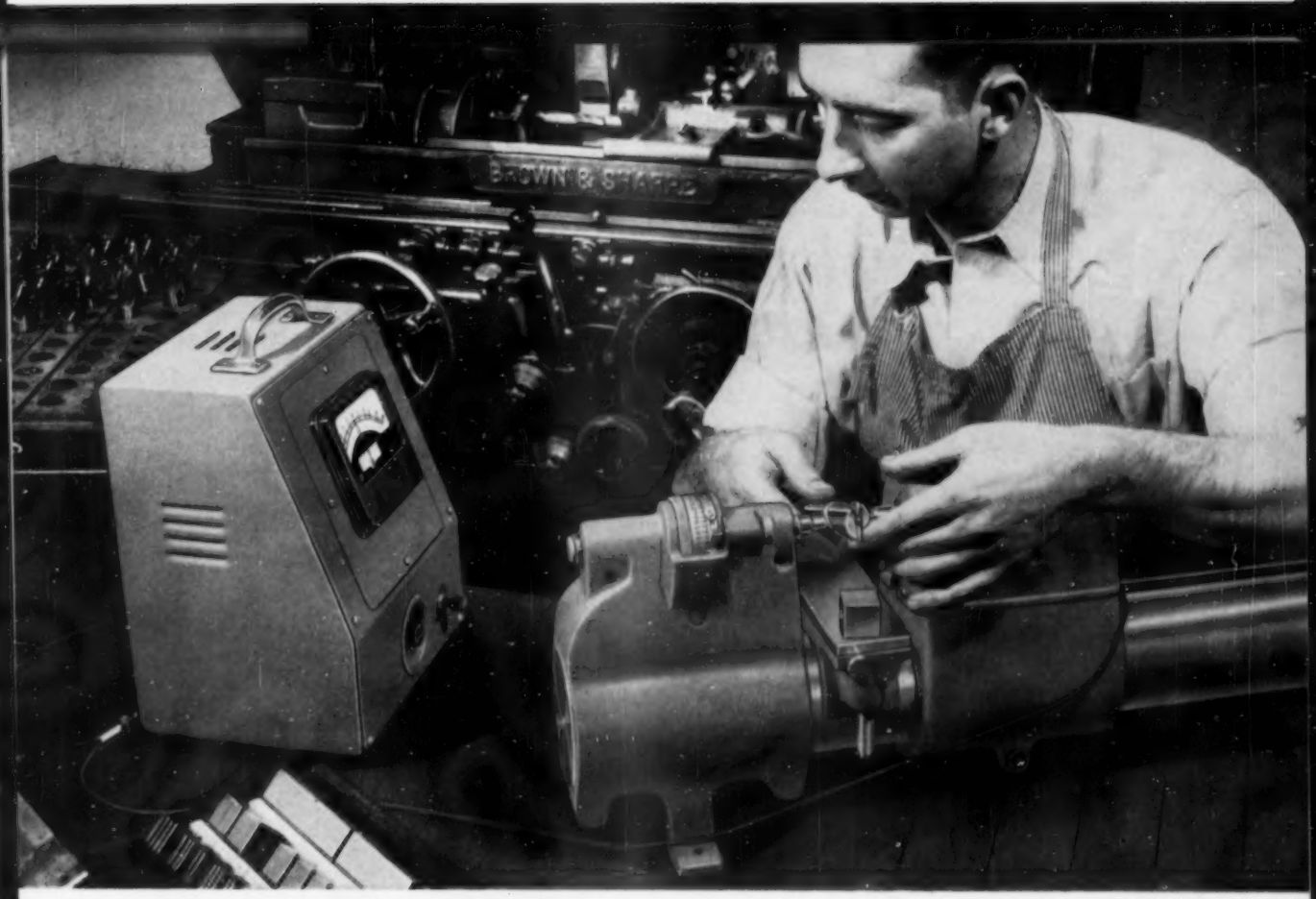
P & W STANDARD MEASURING MACHINE
. . . is used throughout industry to measure gages, tools and finished products for diameter, length, roundness, straightness, parallelism and taper direct to .00001" with controlled measuring pressure.



P & W PRECISION GAGE BLOCKS . . . are the basic standards of precision in thousands of plants. Guaranteed for size, parallelism and flatness within a few millionths of an inch. HOKE Blocks (square type) and USA Blocks (rectangular type) are available in steel or solid carbide.



P & W ELECTROLIMIT MILLIONTH COMPARATOR
. . . was developed by Pratt & Whitney for checking Precision Gage Blocks to a millionth of an inch. An essential item of basic measuring equipment for every plant that must establish and maintain truly high master standards of accuracy.



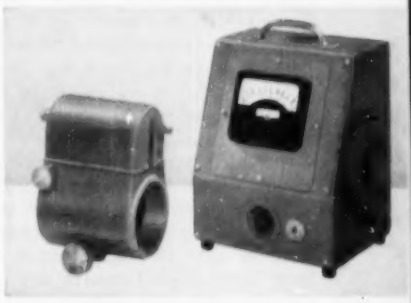
More Effective QUALITY CONTROL *for* HIGH PRECISION PRODUCTION

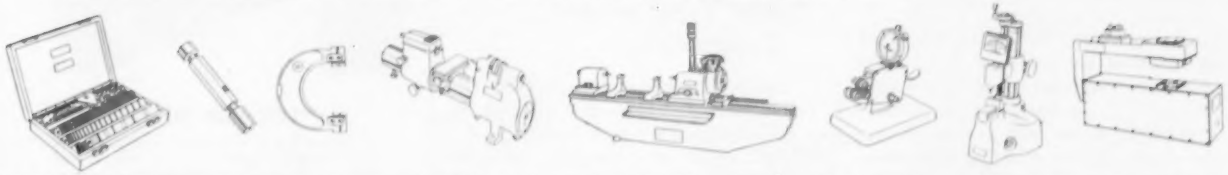
. . . BECAUSE THE *NEW* P & W *ELECTROLIMIT* SUPERMICROMETER IS *EASIER* TO READ *MORE ACCURATELY!*

Equipped with an Electrolimit Tailstock and a high magnification instrument cabinet, the operator can see *at a glance* exactly how much a part is over or under the required dimension. When used as a comparator, deviations are read directly to .00002" on the meter, which has a full scale of .001". The Supermicrometer is now an even more effective means of eliminating errors and reducing scrap losses from high-precision work. Particularly useful for process and final inspection, the Electrolimit "Supermike" is also ideal for use at the machine on lapping, fine grinding and other precision work.

CONVERT YOUR OWN SUPERMICROMETER . . . to an Electrolimit type with packaged unit shown here. Conversion is simply a matter of replacing the old tailstock with the new Electrolimit type.

Write now for complete information about the new P & W Electrolimit Supermicrometer or the Electrolimit Conversion Package. Pratt & Whitney Company, Incorporated, 16 Charter Oak Boulevard, West Hartford, Conn.





GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

120 strokes per minute.

Jemco H-20 is equipped with a dividing head with tailstock, a swivel vise, a 12¼ x 12¼-in. table with suitable locking jaws, two tool-holding fixtures and a worktable which can be swiveled to any angular position according to a graduated scale. This swivel table can

be locked in 3 main working positions and is provided with fitted in clamping devices to avoid exchanging and resetting work.

Jersey Mfg. Co., 455 Livingston St., Elizabeth, N. J. **T-6-32**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Liquid Locking Sealant

Any kind of threaded fastener can be locked with any torque by use of Loctite sealant. Studs treated with the liquid can be permanently secured without the use of interference threads, and they can be sealed fluid-tight. Ordinary nuts and machine screws can be locked with a grip that is 60-70 percent of the torsional strength of the fastener, providing maximum resistance to vibration, without danger of breaking the fasteners in disassembly. Although the sealant locks conventional threaded fasteners so securely that vibration cannot shake them loose, such fasteners can be removed readily with ordinary tools.

Loctite sealant, which is a clear, thin liquid, wicks into the engaging threads and hardens automatically in 24 hours to form a tough heat and oil resistant plastic. This hardened plastic provides a gripping action which extends over the entire surface of engaged threads, resulting in a grip proportional to the engaged length.

Grip of the fasteners can be controlled by the grade of sealant used. Loctite sealant is available in four strengths, with the strongest grade ten times the strength of the weakest grade. Thus, by either varying the engaged length or changing the grade of sealant, the user can control gripping torque to meet specific requirements.

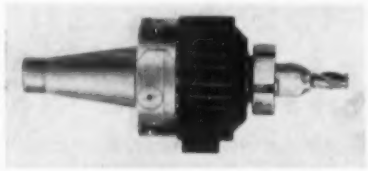
Metal fasteners can be treated in large lots or individually with equal ease. In the multiple application method, degreased fasteners are treated by briefly tumbling with the required amount of sealant. The sealant remains liquid until the fasteners are used in an assembly, when it hardens automatically. With tumbling method, one 10 cc. bottle is sufficient to treat 1000 #10 machine screws. For larger fastenings and for noncontinuous production operations the workman puts a drop of Loctite on each critical fastening at the last station of the assembly line.

American Sealants Co., 103 Woodbine St., Hartford 6, Conn. **T-6-33**

End Mill Driver

Provision for offset positioning is incorporated in this end mill driver which produces an orbital motion of the cutting tool. This motion permits one-pass cutting of keyways with undersize end mills and reduces need for special diameter sizes. The eccentric motion, which has the same speed as the spindle, also increases chip clearance, assures square slots and permits milling true-to-centerline on keyways.

The driver has a 4:1 speed ratio be-



tween the spindle and the cutter, which enables it to do work while the machine idles.

End mill shank sizes from ⅜ to 1 in. can be accommodated. Eccentric micrometer positioning ranges from 0 to 0.062 in. off center.

Portage Double-Quick, Inc., 1054 Sweitzer Ave., Akron 11, Ohio. **T-6-34**

Power Transmission Components

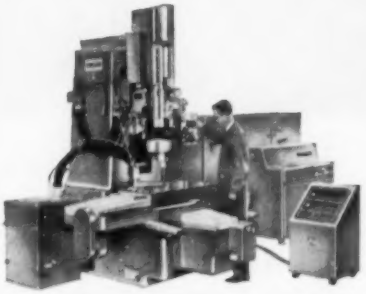
Start-stop power drive and cyclic control device, trademarked Cycledyne, is a self-contained fan-cooled package, designed for use on both new and modernized machinery. It provides fast and accurate electromagnetic action, while minimizing shock loading, power overload peaks and electrical contact arcing.

Cyclic operational functions for the equipment are readily provided by the unit. During power drive phase of each cycle, the Cycledyne also functions

PRATT & WHITNEY NUMERICAL CONTROL APPLICATIONS

ELECTROLIMIT JIG BORER

Equipped with Numerical Control, the P&W No. 2E Jig Borer is equally suitable for toolroom and precision production applications. Settings accurate to .0001" are made automatically from data supplied by a punched tape or an operator's keyboard.



VERTICAL PRECISION HOLE GRINDER

Table and carriage are similar in design to the No. 2E Jig Borer and the same ultra-precision Electrolimit Measuring System is employed. Column, however, is equipped with interchangeable, turbine-driven grinding heads for spindle speeds to 100,000 rpm.

PRECISION ROTARY TABLES

These Pratt & Whitney Rotary Tables are the ultimate in precision and convenience for circular spacing, graduating and angular positioning. Settings accurate to 5 seconds of arc (2 seconds for repetitive settings) are made automatically from data supplied by punched tape or operator's keyboard.

PRATT & WHITNEY

TO "TENTHS" IN SECONDS

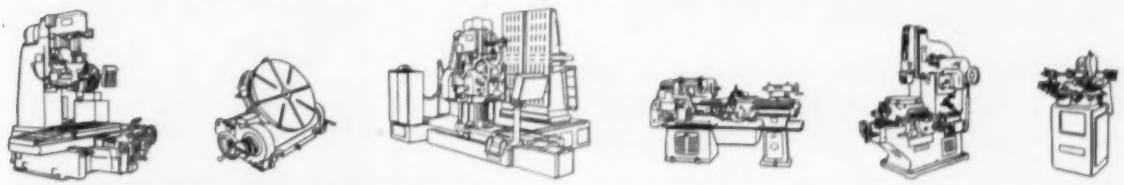
. . . *and no mistakes!*

WITH NEW PRATT & WHITNEY NUMERICAL CONTROL

Operating under Numerical Control, this P&W Precision Hole Grinder is positioned and re-positioned – accurate to .0001" – in an average of only 14 seconds! And since settings are controlled by a punched tape, the chance of work spoilage through operator error in reading blueprint data or setting dials is eliminated. The operator is free to concentrate his attention on work quality.

Applied to Pratt & Whitney Jig Borers, Precision Hole Grinders, Rotary Tables and special machines, Numerical Control not only speeds up toolroom operations, but also makes the high precision of these machines available for efficient short- or long-run production work. In this type work, time savings up to 40% over manual operation are realized. Compare the performance of your present manually-controlled machines with the new standards of speed, accuracy and economy being established by numerically-controlled P&W equipment. If they don't measure up, you are missing important opportunities for improved work quality, larger savings and greater profits.

Write now for complete information.
Pratt & Whitney Company, Incorporated,
16 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

Cold-Heading Costs Far Less . . .

WITH P&W-JAQUITH CARBIDE HEADER DIES, PUNCHES, CUT-OFF QUILLS AND KNIVES . . .

Compared with steel tooling, they run longer, produce more and require lower inventories. Improved quality increases product acceptability, cuts inspection costs. These carbide tools are now offered as stock items for National and Waterbury Farrel Cold Heading machines. Specials can be furnished on short delivery from available blanks.

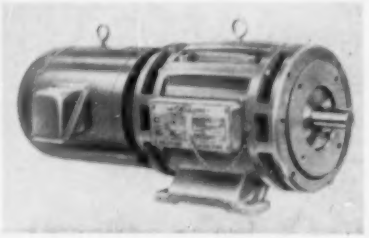
Write now for complete information. Jaquith Carbide Division, Pratt & Whitney Company, Inc., 15 Stewart Street, Lynn, Massachusetts.

JAQUITH CARBIDE
DIVISION OF PRATT & WHITNEY COMPANY, INC.
SPECIAL DIES • COLD HEADER PARTS • WEAR PARTS

as a power transmission, with no efficiency loss due to slippage.

The machine operational functions also may be conveniently controlled by manual or automatic remote switching devices, and sequencing circuits will provide any extent of automation. These switches and circuits carry only the electromagnetic energizing current for the Cycledyne, which is less than ½ amp for sizes rated to 50 hp. No mechanical, hydraulic or pneumatic accessory devices are required.

There are five basic sizes, all similar in external appearance to a double-



Foot-mounted, open, fan-cooled Cycledyne, with NEMA face mounting at input-end for drive motor, and NEMA face mounting at output-end for mounting of speed reducer or other power drive components.

shaft extension electric motor of comparable size. Each is available in open splashproof or totally enclosed models, with foot, flange or face mounting options that are compatible with NEMA electric motor dimensions of equal horsepower rating. More than 200 combinations of frame assembly variations and interchangeable design modifications are possible.

Each size and design is available with integrally mounted accessories, such as offset drive motor mounting bases, coaxial fixed ratio speed reducers mounted on the output shaft end, integrally assembled adjustable ratio speed changers and fail-safe stopping provisions.

Cycledynamics, Inc., 19025 W. Davison, Detroit 23, Mich. **T-6-35**

Extra Length Drills

High-speed steel extra length drills are designed for operations where inaccessibility is a problem or for extremely deep holes. They perform satisfactorily under a broad range of operating conditions and materials. Excellent service can be given on either straight

or taper shank styles and in wire gage or fractional sizes.

Diameters of these drills range from No. 52 wire gage to 1½ in. with overall lengths to 23½ in. Larger diameters and longer lengths also can be furnished.

Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. **T-6-36**

Rotary Slitting Shear

A heavy-duty slitting shear, designated Model 1025, slits sheets or coil stock from 24 to 10 ga at speeds up to 60 fpm.

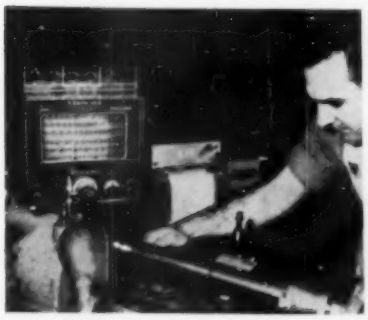
Throat of the machine is 25 in. deep; minimum width of cut is 1½ in. Antifriction roller guide rail is readily adjustable and locks in place. The rotary

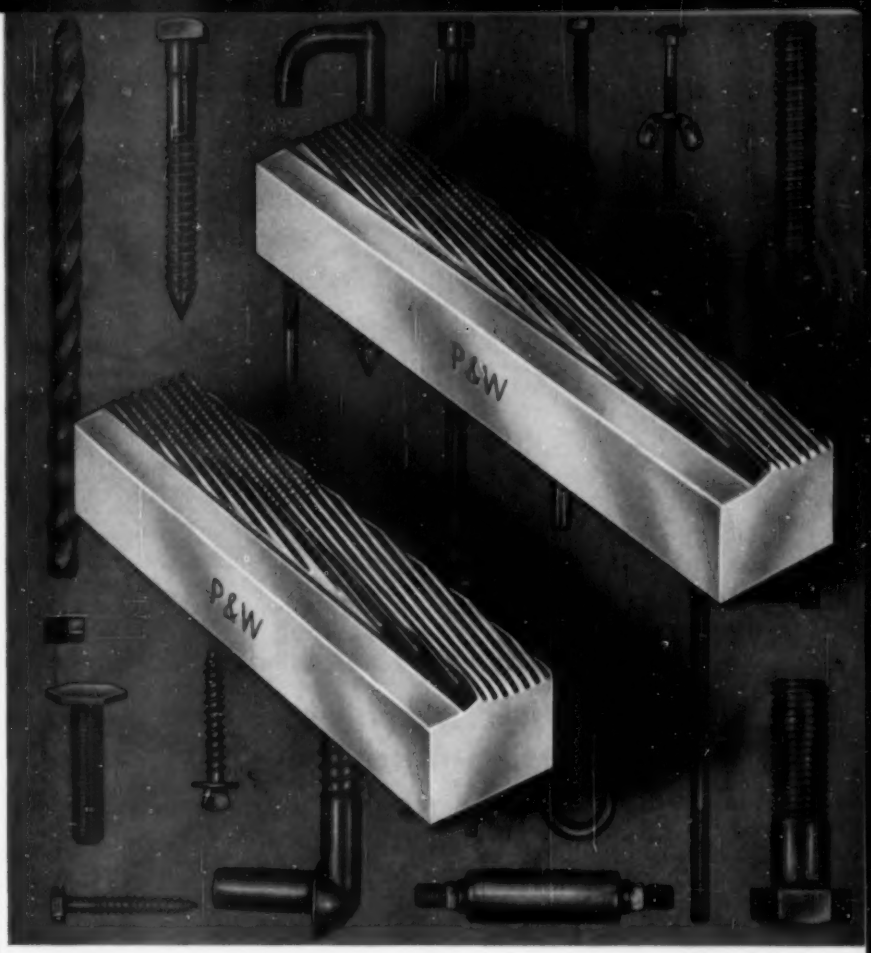
slitting blade is reversible, and the cutting edge may be resharpened many times. Motor and speed reducer are housed in base of the machine. A manual overload switch provides for motor protection.

The Flagler Corp., 19321 Filer Ave., Detroit 34, Mich. **T-6-37**

Ultrasonic Tester

This ultrasonic test equipment permits attachment of automatic detection and recording devices to provide location of thickness changes in metals and





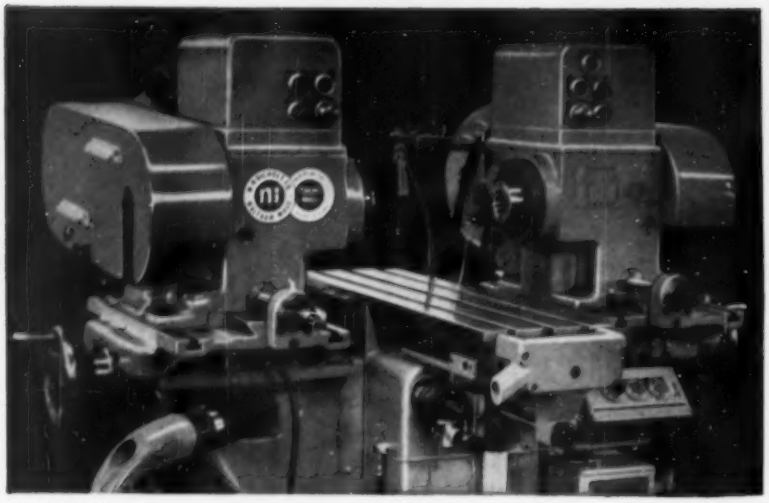
ROLLING Produces More Accurate Threads...FASTER!

WITH P&W-STERLING THREAD ROLLING DIES

. . . Thread Rolling is rapidly replacing older production methods. Long-wearing P&W-Sterling Dies produce threads that are more uniform and accurate than cut threads and have a hard, burnished finish. Important savings in material are realized. Production rates are very high, production costs low. Sterling Dies are stocked and sold by the P&W Branch Office near you.

Write today for complete information. Sterling Die Division, Pratt & Whitney Company, Inc., 13811 Enterprise Ave., Cleveland 11, Ohio.

STERLING DIE
DIVISION OF PRATT & WHITNEY COMPANY, INC.
THREAD ROLLING DIES FOR ALL APPLICATIONS



Twin Mill

NICHOLS MILLERS...

Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

Nichols 8SA Semi-automatic

The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic downfeed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you?

Manufactured by **W. H. NICHOLS COMPANY**

National Distributors **THE ROBERT E. MORRIS COMPANY**
REM SALES DIV.
5006 FARMINGTON AVE. • WEST HARTFORD 7, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-180

plastics as small as 5/100 of one percent. The equipment also can be connected in order to ring an alarm, flash a signal light, or activate compensating controls of various sorts.

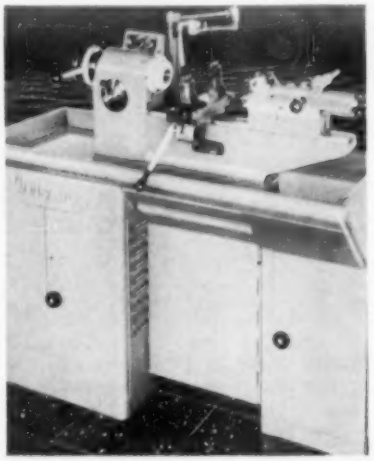
Branson Instruments, Inc., 37 Brown House Rd., Stamford, Conn. **T-6-38**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hand Turret Lathe

Electric-clutch hand turret lathe, designated #94, offers operational ease and speed through the use of infinitely adjustable speeds in conjunction with electric clutches for speed changing and reversing.

Push-button operation of a servo-mechanism provides a range of infinite spindle speeds with 140 to 3500 rpm. Standard constant-speed motor powers



this whole range of speeds without reversals or change of speeds by the motor itself. Thus, the motor is protected from heat build-up and absorption of power from this source.

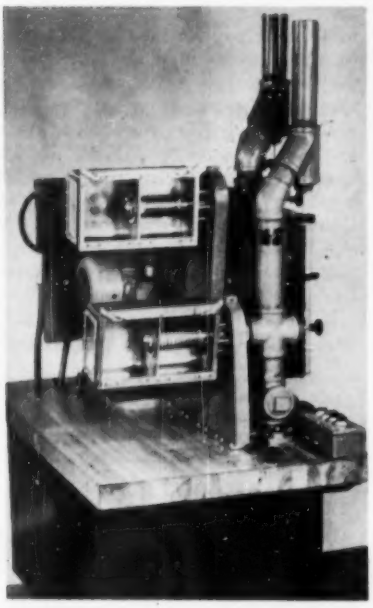
Electric clutches provide immediate high-to-low spindle speed ratio of 5:1. Unlimited reversal of the spindle is also obtained by electric clutch.

The Wade Tool Co., Waltham, Mass. **T-6-39**

Automatic Loader

A wide variety of parts can be loaded automatically with a machine using the "blow-loading" principle. The unit, called the Freeloader, will handle almost any number of parts at a fast rate with equal efficiency.

Air pressure introduced into an oscillating loading drum forms a vortex at each orifice of the collecting pattern. As the drum oscillates, the parts pass



back and forth through the vortices until they are drawn into place. When a part enters, it seals the orifice and will remain in place until the air pressure is released. Loading ordinarily is accomplished in 30 sec. to 3 min.

Within reasonable limits, part size alone does not affect the loading operation. Three Freeloader models are available: Model A-3, double drum, individual drives; Model A-2, double drum, single drive; and Model A-1, single drum, single drive.

Whitso, Inc., Blow-Loading Div., Dept. TED, 9330 Byron St., Schiller Park, Ill. **T-6-40**

Small Wheel Air Grinders

Line of small wheel air grinders, called the M1170, include: M1170, a short type small wheel grinder; M1171, which is a long type; and M1172, which is a small-end type.

This series offers 50 percent more power than available from previous models. Balanced centrifugal governor on all speeds provides maximum power and peak performance. Simplified construction assures easy maintenance. From the basic M1170 motor at three speeds, with five spindles and three handles, 45 basic models and 20 different arbors and collets can be made up. The grinders have wheel capacities from 1 x ½ in. to 3 x ½ in. vitreous, and 2 x ½ to 3 x ½ in. elastic.

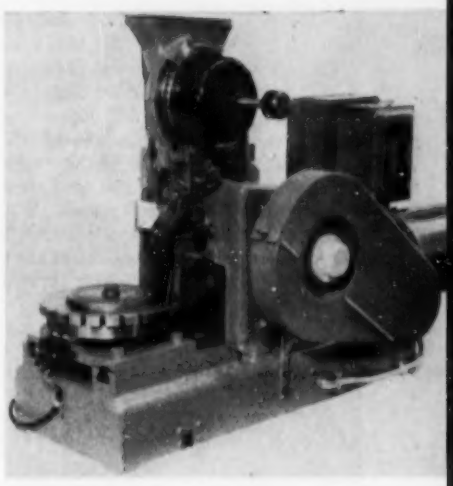
The Rotor Tool Co., 26300 Lakeland Blvd., Cleveland 32, Ohio. **T-6-41**

At top is M1172, snap throttle, wheel arbor and straight wheel. Center is M1171, straight spindle, twist throttle, ¼ in. collet. Below is M1170 QAW throttle, standard spindle, collet. All have steel rear head.

Riveting Machines

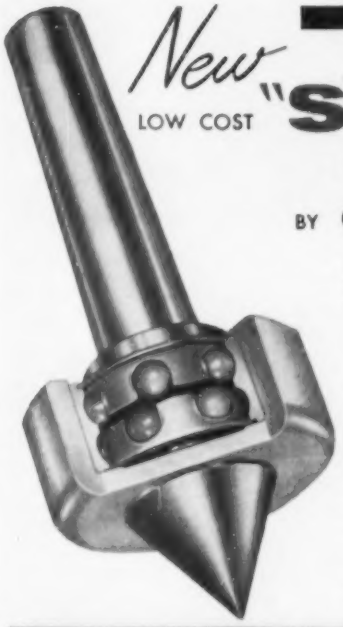
Three riveting machines for special purpose applications include: Model FS, multispindle pneumatic machine for production operations; Model FM, pedestal type machine with extra-long stroke for riveting in deep channel sections and hard-to-reach areas; and Model RT-52 (illustrated), an automatic dial-fixture machine for light work.

The multispindle pneumatic model, available with either pedestal or bench type base, can set tubular steel rivets



ranging from ⅛ in. in diam and 9/16 in. long, down to 0.06 in. diam. and 3/32 in. long. Built with a 4-spindle head for simultaneous riveting operations on long, flat parts, this machine can be made with from 2 to 6 heads, each fed by an automatic rotary hopper.

Air cylinders are designed to operate off shop air (80 psi min.), and elec-



New LOW COST **"SPINOSE"** LIVE CENTER BY IDEAL **$19.95**

This new IDEAL Live Center is especially built to provide:

1. *A Low Cost Live Center* that you never have to repair. After it has paid for itself many times over through long service life you simply replace it at less cost than repair charges on most centers.
2. *Excellent Accuracy* which is insured by twin-row, angular-contact, preloaded ball bearings, handling both radial and thrust loads. Entire nose (point and bearing housing) turns with the work.
3. *Good Load Capacity* comparable to other Live Centers costing more than half again as much.
4. Available in Morse Tapers 1, 2 and 3.

Check these facts with your Distributor and we know that you'll find that the new IDEAL "Spinose" offers more dependable service and all-around advantages than most live centers costing up to 50% more.

CALL YOUR DISTRIBUTOR OR MAIL COUPON TODAY!

For widest range of sizes, types and tapers ask your distributor or write for complete information about the complete line of new Ideal Gold Band Live Centers.

IDEAL INDUSTRIES, INC.
4152-F Park Ave., Sycamore, Illinois
Please send complete information about the new IDEAL "Spinose" Live Centers.
Name_____
Company_____
Address_____
City_____ Zone____ State_____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-181

trical equipment can be specified for operation on 110, 220, or 440 volts. Throat depth is 7 in; stroke is 1¼ in; anvil height, 40 in; minimum center distance between heads is 3.67 in.

The long stroke machine, Model TM, is available with quick change raceways that can be applied to feed rivets of various diameters and shapes. With a throat depth of 9½ in., this unit is capable of handling steel tubular rivets ⅛ in. in diam by ⅛ in. long through 3/16 in. diam by 1 in. long.

The anvil bracket can be positioned at various heights, but the machine is designed to operate on only 6 in. length of stroke. Rivet setting is accomplished with a toggle mechanism that is actuated with either a mechanical trip or a solenoid foot switch and solenoid trip.

The dial type Model RT-52 was specifically developed to rivet ball bearing retainer rings, but it is also applicable to other riveting operations. The dial fixture is automatic. When the cycle is actuated, the machine table will index 360 deg. through from 6 to 36 stations and automatically stop when completing the riveting operations. The entire fixture can be positioned to handle retainers from 2 to 6½ in. pitch diameter and the stations can be adjusted for the number of positions required.

This model also is equipped with quick change raceways. Since the flywheel speed is only 78 rpm, the machine is capable of handling only rivets up to 1/16 in. diam or tubular steel rivets up to 3/32 in. diam. A spring-loaded connecting rod automatically compensates for variations in material thickness.

Milford Rivet & Machine Co., Milford, Conn. **T-6-42**

Conventional plug gages cost a lot more than shows in the price list!

Let Du Bo® show you how

You can cut plug gage costs 60%

SEEMINGLY economical, conventional plug gages are actually costly. They are difficult to use, slow in low tolerance work and have a tendency to "freeze," causing lost time, excessive wear on the plug or damage to the product.

STANDARD'S Du Bo Plug Gages are *more efficient* and basically *far more economical*. 3 times as fast to use, they require a minimum of training to detect tolerances of less than .0001". Du Bo's will not "freeze" or mar surface finish. They weigh 80% less than the average plug. Users report that they outwear plugs at least 6 to 1. The best proof of all this is an actual demonstration in your plant. Ask the *Man-from-Standard* or write Standard Gage Company, Inc.

STANDARD Gages®

POUGHKEEPSIE, N. Y.

A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE LIMIT TYPES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-182

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cavity Milling Tool

Designed for deep-cavity milling of titanium, stainless steel, aluminum and other alloys, this tool, called the Rout-R-Mill, has a flute structure to provide fast chip clearance at great depths. It

accomplishes rough, hogging cuts and finish cuts in one operation.

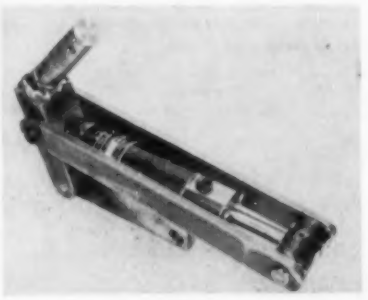
The mill can be used at speeds up to 17,000 rpm at unusually fast feeds.

Comparison sketches in the illustration show the difference between the design of a standard end mill and the Rout-R-Mill.

Arrow Tool & Reamer Co., 711 Stephenson Hwy., Troy ,Mich. **T-6-43**

Double-Acting Hand Pump

Double-acting adjustable-leverage hand pump, Model 1687, for 10,000-psi hydraulic pressure has an internal tog-



gle linkage and a capacity of 0.475 cu in. per cycle (two strokes).

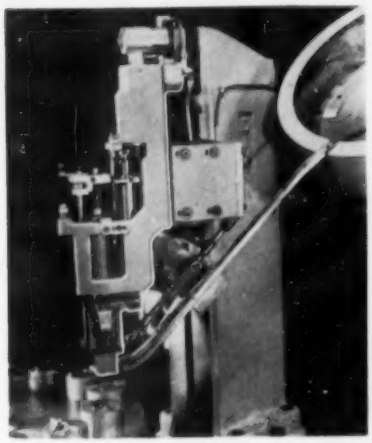
Designed primarily for cranes, stackers, winches, and other material-handling applications, the pump is normally used with a 28-in. length of ¾-in. pipe for a handle. Handle can move through a total arc of 72 deg but for convenience is ordinarily operated through only half that distance. At 10,000 psi, the operator will use the left-hand portion of the stroke for a 3.5:1 mechanical advantage.

When utilized to lift light loads at lower pressures in material-handling applications, the right-hand portion of the stroke provides three times the usual speed.

Mechanisms Co., 118 E. 2nd St., Uhrichsville, Ohio. **T-6-44**

Automatic Parts Positioner

Standardized automatic parts positioner is capable of accurately guiding parts 1/16 to 3 in. at rates up to 7200 per hour from feeder track to fixture. Designated Model PR-3, it is a self-contained, standardized unit that may be nested on 3-in. minimum centers along an in-line transfer table, or may be located at adjacent stations on a 5-in. radius dial indexing table having as many as 12 stations. Full electrical



controls are included, with provisions for automatic interlocking. Normal air operating pressure is 80 lb. Individual units are available in strokes of 1, 2, 3 or 4 in. with adjustable speed up to ½ sec. per cycle. Base of the ram is engineered for mounting individually designed chuck jaws to suit varied requirements.

For setup purposes, a simple hand-operated pop-up valve is included to initiate the cycle, making it easy to check adjustment and performance without indexing work fixtures or manipulating remote circuit. In operation,

Jarvis Adjustable Pitch
LEAD SCREW TAPPER

NEW!

. . . a cost-cutting OPPORTUNITY you can't afford to miss! One tapper . . . one lead screw . . . convertible in SECONDS to tap *different* pitches!

ANOTHER Jarvis FIRST!

send this coupon TODAY!

Jarvis Corporation
Middletown, Connecticut

Yes! I am interested in this new, Jarvis First—the Adjustable Pitch Lead Screw Tapper.

☐ Send details and prices
☐ Have a Jarvis representative call
☐ We would like a demonstration in our plant

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COMPANY.....
ADDRESS.....
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-183

Versatility in Forming-

NILSON 4-SLIDES

Simple or complex metal forms in wire or ribbon metal is no problem on a Nilson. Tooling for basic forming can be augmented by provision for operations such as welding, assembling or swaging. Open design on all forming elements provides for quick tool change and easy adjustment even from wire to metal forming on the one machine that does so many jobs so well. The universal Nilson 4-Slide is the economical answer to your forming problems. Size ranges—wire up to ½" dia. in feeds to 32" max., ribbon stock up to 3½" wide. 5 to 75 ton press sections. Our specialists can assist you in all types of forming requirements.

THE A. H. NILSON MACHINE CO.
1920 BRIDGEPORT AVE. SHELTON, CONN.

NILSON

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-184

the positioner serves as an efficient sensing device. If a part is missing or improperly placed, the machine stops automatically with ram in forward position.

Setup illustrated is used for assembling clock-winding key bows accurately into slotted stems. Stems are positioned and oriented in preceding station and, at a subsequent station, a staking operation is employed to secure the two parts together.

Dixon Automatic Tool, Inc., 2300 23rd Ave., Rockford, Ill. **T-6-45**

Turret Lathe

This model #00 turret lathe, intended primarily for secondary operations, can be operated with speed and efficiency by unskilled employees.

A single synchronized, cam-actuating lever locks the workpiece into position ready for any of the eight existing functions. The lathe will center, cut off, spot

face, drill, thread, turn, form, chamfer and pinpoint round workpieces up to ⅝ in. in diam. It will hold concentricity to within 0.0003 in.

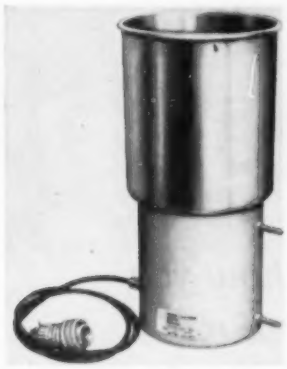
Used to relieve larger equipment, this lathe is small enough to be portable. It is designed especially for continuous production of small parts.

Made by Clark Engineering and Mfg. Co. for Cem-Way Sales Co., Box 99, Bristol, Wis. **T-6-46**

Ultrasonic Cleaner

Compact ultrasonic cleaner is designed for continuous duty on production line or in the laboratory. It may be used for cleaning meters, high precision parts, watch movements or other complex or delicate parts and assemblies.

The unit is magnetostrictive type and uses 5 amp polarizing current. It op-



erates off a generator of 250 watts output or more. The stainless steel tank has a 1 gal capacity.

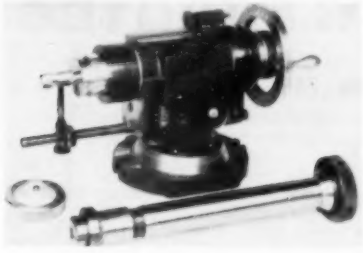
Alcar Instruments, Inc., 17 Industrial Ave., Little Ferry, N. J. **T-6-47**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Grinding Fixture

The Studler all-purpose tool and cutter grinding fixture permits grinding of straight or spiral-fluted tools with correct reproduction. With the spring head and multiple lobe cams, all end-cutting tools can be ground fast and accurately with the correct relief.

Capacity of the tool ranges from 0 to 1½ in. For index grinding, the hand-



wheel has 24 equally-spaced holes on one side and 35 holes on the other side, offering 11 different shapes that can be ground. Handwheels with other hole combinations can be furnished specially. The handwheel can be clamped any place on the shaft.

S & D Engineering Co., 2051 W. Mountain St., Glendale 1, Calif. **T-6-48**

Geared Lathe

Tray-top high-speed geared-head precision lathe for toolroom and production work is arranged for direct multiple V-belt motor-drive. Start, stop and reverse of spindle is operated by double multiple-disk friction clutch.

Headstock has 18 spindle speeds, ranging from 15 to 1500 rpm in geometric progression. It is 2⅝ in. spindle bored throughout and equipped with long taper-key drive-nose #LI for U. S. chucks and runs in high-precision roller bearings.

Entire bed of this lathe, called the 17-in. #S450 Progres, is cast in one piece with machine legs, providing maximum strength and a vibration-free block.

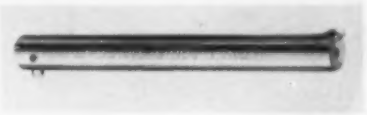
Enclosed quick-change gearbox provides 40 feeds for turning and facing, 40 U. S. standard threads, 40 metric, and 40 course threads.

Units available have 39 in., 59 in. and 78 in., center-to-center distances.

Built by Le Progress Industriel, S. A., Brussels, Belgium, to American standards. Imported by Parker Machine Co., Inc., 158 Pioneer St., Brooklyn 31, N. Y. **T-6-49**

Boring Bars

Line of boring bars are made from a heavy metal, called No-Chat, that reduces vibrations. They offer unusual rigidity and resistance to deflection. Speeds and feeds can be increased, and



the bars can be used with considerable overhang for deep hole boring.

Seven boring bars range in over-all lengths up to 12 in. Cutting tools are finish ground from solid carbide.

Wendt-Sonis Co., Hannibal, Mo. **T-6-50**

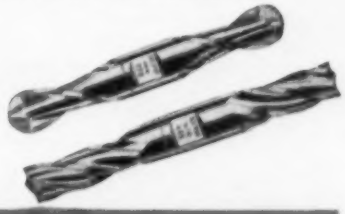
FINE CUTTING TOOLS by Eclipse

Since 1913 Eclipse has been consistently and conscientiously serving many companies in widely diversified fields of production. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools.

- High Speed Steel Cutters
- Carbide Tipped Cutters
- Core Drills
- Inserted Blade Cutters
- Multi-Diameters
- Back Spotfacers

and remember . . .

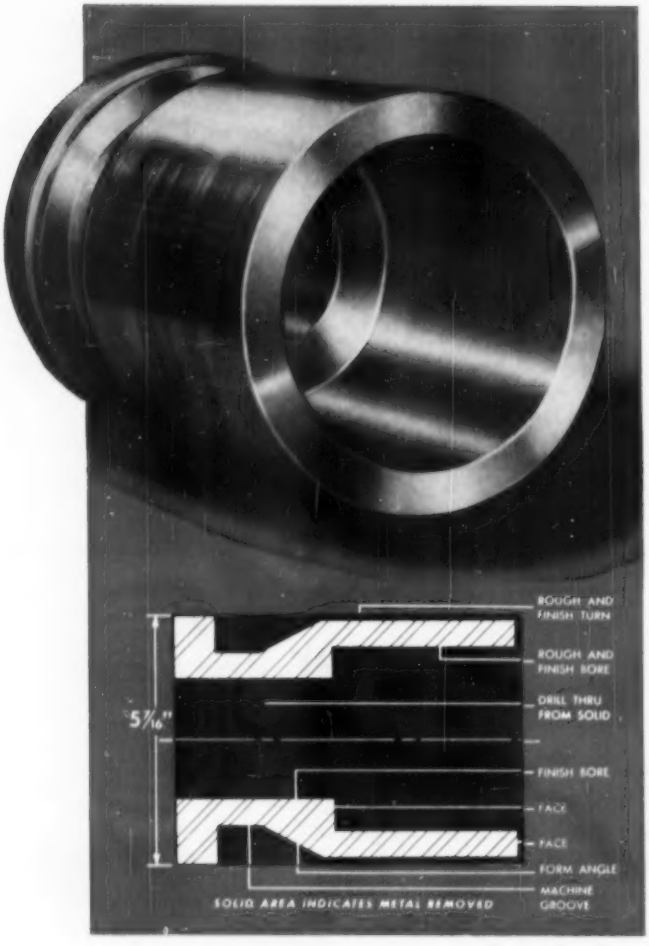
Eclipse now has a complete line of Precision End Mills. Ground from the solid, Eclipse End Mills insure longer tool life, finer finishes and lower production costs.



- Write for Counterbore Cat. No. 51
- Write for End Mill Cat. No. 56

ECLIPSE COUNTERBORE COMPANY
DETROIT 20, MICHIGAN
END MILL DIVISION—NORTH BRANCH, N. J. ADDRESS (BOX 97, RARITAN N. J.)

FOR FURTHER INFORMATION USE READER SERVICE CARD; INDICATE A-6-185



Let me show you how one of our P & J Automatics

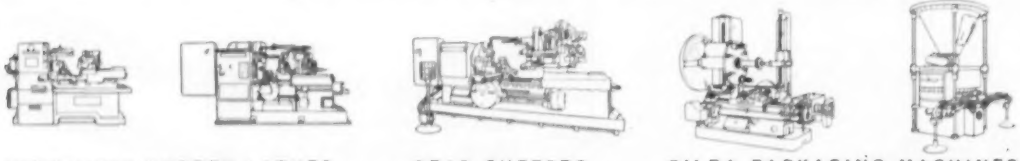
Hogged Out Over

31 POUNDS OF STEEL IN 6¾ MINUTES!

This job looked really tough. Machining from the solid meant unusually heavy metal removal . . . and our customer had to hold some pretty close tolerances and turn out parts *fast*! Here's what did the trick! Our new P&J Automatics have the extra power it takes to hog out metal fast *and* the extra rigidity that's needed to stay within the required limits under the heaviest feeds. You can see how teaming a machine like this with P&J Tooling, to save even more time by combining cuts, made it possible to complete one of these spools every 11 minutes. A new P&J Automatic can bring performance like this into your plant too. Send me your sample prints, and I'll show you how a P&J Automatic with P&J Tooling can help you turn out your toughest jobs faster, better and at lower cost. Write to Potter & Johnston Company, Pawtucket, Rhode Island.

HERE ARE THE FACTS:

PART: *Chuck Operating Spool.*
MATERIAL: *Cut-Off Bar Stock #34 Carbon Steel.*
REQUIRED: *Machine from the solid. Ten separate precision cuts.*
RESULTS: *A part completed every 11 minutes in a single, fully automatic cycle, removing a total of 40 pounds of metal.*
MACHINE: *P & J Model 6DRE-40.*



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . GILDA PACKAGING MACHINES

POTTER & JOHNSTON
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.
PRECISION PRODUCTION TOOLING SINCE 1898

FIELD notes

Training facilities of its Precision Center is being virtually doubled by Brown & Sharpe Mfg. Co. The center, which is only about a year old, serves as a training and demonstration facility where designers, machine operators, tooling experts, distributors and salesmen are taught the latest in tooling and machining techniques. Persons who sell, distribute, buy or use machine tools may attend the courses conducted at the Center. Depending on the subject, classes are limited to from 8 to 30 members. Courses cover screw machine cam and tool design, screw machine maintenance, grinding techniques and salesman training.

Facilities of this unique endeavor include a lecture hall, a revolving stage to better demonstrate equipment, a typical distributor's store with shelf stock and counters, and exhibits of new tools and machines. A complete collection of milling, grinding and screw machines, machine tool accessories, precision tools, pumps, cutting tools and other industrial products is in full operation.

In addition to teaching machine operation, maintenance courses also are conducted.

V V V

Men interested in different facets of the abrasive field have joined to form a national nonprofit technical and study organization. Name selected by the group is American Society for Abrasives. Plans call for organization of chapters throughout the country, and at present they have been founded in New England, the Middle Atlantic states and Michigan. One long range objective of the society is the establishment of uniform standards for abrasives and abrasive products. National chairman of the organization is T. J. O'Connell of the Macklin Co. and president is John Y. Arnold of Carpenter Steel Co.

V V V

Gratis courses are being offered by The DoAll Technical Institute to teach inspection and quality control personnel in industry "How to be Your Own Bureau of Standards". Entire facilities of The DoAll Co. are utilized to provide gaging equipment for use in the program. Curriculum is under the personal supervision of Dr. C. Grage, director of quality control, who has both extensive metrological and practical shop experience.

Toward the close of the four days of the course, which is carried on at a fast and stimulating pace, the attending student uses the principles he has been taught and the instruments and master gage blocks at his disposal to calibrate a set of gage blocks that he has brought from his plant. Upon completion of the course he returns to his plant with the accurately calibrated set plus the experience and know-how to best utilize them.

name changes

Columbia-National Corp. is the new name of NRC Metals Corp. Half interest in the company, formed originally as a subsidiary of National Research Corp. to produce and market rare metals, has been acquired by Columbia-Southern Chemical Corp. a subsidiary of Pittsburgh Plate Glass Co. It will be operated as a jointly owned subsidiary. An eight-man board of directors comprises equal representation of the parent companies.

V V V

Name of Union Carbide and Carbon Corp. has been shortened to Union Carbide Corp. At the same time three divisions of the corporation also were changed. Carbide and Carbon Chemicals Co. became Union Carbide Chemicals Co.; Linde Air Products Co. was changed to Linde Co., and Carbide and Carbon Realty Co. is now Union Carbide Realty Co.

V V V

Name of Olin Revere Metals Corp. has been changed to Ormet Corp. The company is jointly owned by Olin Mathieson Chemical Corp. and Revere Copper and Brass, Inc. According to announcement, the previous name permitted confusion as to the exact extent of the joint effort between the two companies. With completion of plants at Burnside, La. and at Omal, Ohio, Ormet will produce 180,000 tons of primary aluminum a year. Of this, 120,000 tons will be delivered for fabrication to Olin Mathieson and 60,000 tons will be fabricated by Revere.

new facilities

Production has started at the new $6-million factory and office building of The Cross Co. located on a 67-acre plot at 17801 E. Fourteen Mile Rd., Fraser, Mich. near Detroit. This completes the first phase of a long range expansion program being projected by Cross. Features of the new plant, which was created solely for production of machinery for automation, include a simulated line production, a data processing department with a Univac high-speed electronic computer, and an engineering setup that provides intercompany competition for engineering ideas. To provide maximum efficiency in the plant, advanced concepts in organizing and programming work have been integrated with the most up-to-date manufacturing techniques. Anticipated manpower requirements are scheduled to be met as a result of several accelerated training programs now in operation.

V V V

Construction has begun on a new $4-million materials handling equipment manufacturing plant and mid-continent parts depot in Forrest City, Ark. When completed, this summer, it will provide more than 157,000 sq ft of operating area and will be the center of production for lines of hand trucks and hand hoists now being manufactured at the materials handling equipment plant in Philadelphia.

V V V

The new $2½-million West Coast materials handling plant of The Yale & Towne Mfg. Co. will produce a completely new line of heavy duty gasoline fork lift trucks with load capacity of up to 20,000 lb. in addition to producing complete lines of standard gas, LP-gas and electric-powered fork lift trucks, Worksavers and Warehousers. In August the plant also is scheduled to begin production of the Trojan line of bulk materials handling equipment.

V V V

An ultramodern manufacturing and repair plant is under construction for Westinghouse Electric Corp. at Compton, Calif., near Los Angeles. The concrete and steel structure, which is scheduled for completion by November, will provide 80,000 sq ft of plant area in addition to 8000 sq ft of office

space. It will replace the company's present manufacturing and repair plant in Huntington Park.

V V V

Construction has been started on a new plant and main office in Bloomfield, Conn. for Allen Mfg. Co. Move of equipment and employees into the new facility is expected about August, 1958. The structure, which will cover more than 250,000 sq ft, has been designed to provide maximum efficient work flow from materials to finished goods ready for shipment.

V V V

Construction of a malleable foundry at Link-Belt Co.'s Ewart plant in Indianapolis is under way. The foundry, which will incorporate the latest techniques and mechanization in foundry practices, is scheduled to go into operation during December or early in January of 1958.

V V V

Borg-Warner Corp. plans to invest approximately $26-million in new plants and equipment this year. The largest single disbursement will be toward completion of the new chemical plant of the corporation's Marbon Chemical Div. which will manufacture a hard, tough plastic called Cycolac.

V V V

Allegheny Ludlum Steel Corp. has announced plans for construction of three new buildings to be built this year at the company's research and development laboratory in Brackenridge. The program involves addition of two laboratory buildings and an administrative building which will make it possible for the firm to centralize all its research facilities at this location.

V V V

A factory branch office for Brush Electronics Co. has been set up in Los Angeles at 1960 S. LaCienega Blvd. The facility will serve as western regional headquarters for service and repairs in the western states.

licenses

Exclusive rights to license the process and equipment for pelletizing iron ore by the Erie Mining Co. shaft furnace method have been acquired by Surface Combustion Corp. Surface is presently constructing 24 furnace units for the Erie commercial taconite plant at Hoyt Lakes, Minn. This $300-million project will have a designed capacity for initial production of 7½-million gross tons per year. Surface also is building three units for the pelletizing plant at Hilton Mines near Ottawa, Quebec.

V V V

Nylok Corp. has licensed Lamson & Sessions Co. to produce its line of self-locking screws and bolts. Initially, L&S will start production of the fasteners in its main Cleveland plant.

V V V

L. A. Young Spring & Wire Corp. has acquired license rights from Eastern Metals Research Co., Inc., to manufacture and sell the Neg'ator constant-force spring in high volume automotive applications.

corporate changes

Contracts for the sale of Hufford Machine Works, Inc., to Pacific Industries, Inc., have been signed and application for approval by the California Corp. Commission has been made. When finalized, Hufford stockholders will receive 141,300 shares of Pacific Industries stock in exchange for their interests. Included in the sale is the Hufford-owned Smith-Nelson Corp., the Vacu-U-Lift Co., and Fonda Corp., all of which now become divisions of Pacific Industries.

V V V

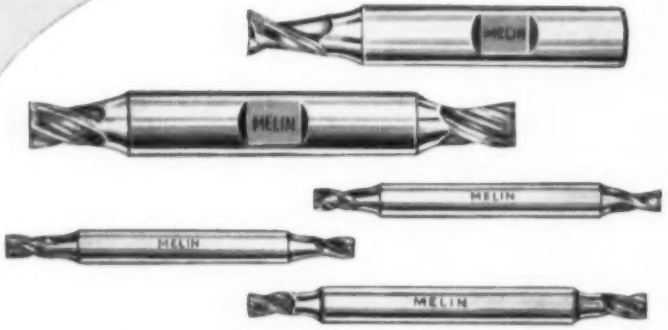
Completion of plans to purchase the assets of the Plew Tool Co., Inc., in Columbia City, Ind., have been announced by The Weatherhead Co. The new company will be known as Plew

MELIN

STUB LENGTH END MILLS
with flutes shorter than regular

Offer GREATER STRENGTH...*

TWO, THREE AND FOUR FLUTE



...★ Plus an Exclusive... In addition to manufacturing a complete line of End Mills, the Melin Tool Company makes several standard Stub Length Mills exclusive of other tool manufacturers.

The new Melin Tool Catalog No. 54-C lists the specifications on these all inclusive Stub Length Tools... and... they offer greater strength and less breakage. Write for your catalog... today.

Representatives in Principal Cities

MELIN TOOL COMPANY, INC.
3372 West 140th Street
Cleveland 11, Ohio

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Tool Corp. There is no change expected in the nation-wide distribution policy. Plans are being made to expand facilities of the plant to more than twice its present capacity.

V V V

Report of the acquisition of the business and assets of The Lima Electric Motor Co. by a wholly-owned subsidiary has been announced by Consolidated Diesel Electric Corp. This represents a step in a program of diversification within the fields of diesel and electric generating equipment, aircraft ground support equipment and test and automation equipment.

V V V

With approval of the stockholders of both corporations, Birtman Electric Co. was merged into Whirlpool-Seeger Corp. Officers and directors of Whirlpool-Seeger Corp. continue as the officers and directors of the merged corporation which will be called Whirlpool Corp.

V V V

Federal Wire & Cable Co., Ltd. of Guelph, Ontario has been acquired by H. K. Porter Co. (Canada) Ltd. Harold F. Nunn, vice-president of Porter's Canadian organization, is moving his headquarters from Toronto to Guelph to supervise the new operation while he continues to supervise Porter's other Canadian business.

V V V

Assets of General Industrial Products Co., Inc. have been acquired by Minnesota Rubber and Gasket Co. which now will be operated as a division, known as Minnesota Latex Rubber Co.

V V V

Assets of Rex Welder Co. have been acquired by Peer Inc. thereby doubling its production facilities. Peer will continue to market welding equipment under both brand names of Peer and Rex and no changes are planned in existing distributor organizations.

expansions

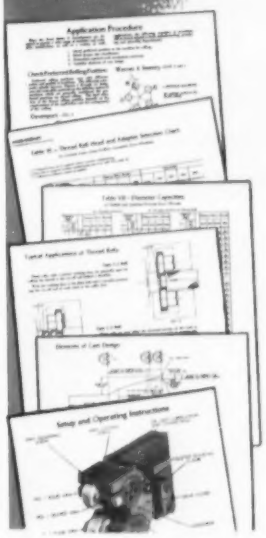
Standard Pressed Steel Co. plans an expenditure of $9-million on plant and equipment this year. This is almost $2-million higher than earlier estimates for 1957.

V V V

Completion of a major expansion program, including a move of facilities to a new plant in the Southwest Industrial Park section of Cleveland, has been announced by Sterling Die division of Pratt & Whitney Co. Inc. An open house for clients and customers marked

THIS BOOKLET . . .
Simplified Our Tool Planning and Helped Us Speed Up Production
WITH OUR
REED
Thread Rolling Attachments

Application and Operating Instructions
REED THREAD ROLLING ATTACHMENTS SERIES B, TWO-ROLL TYPE
REED ROLLED THREAD DIE CO.



Engineers, setup men, operators . . . all find helpful information in this booklet, "Application and Operating Instructions," furnished with every Reed Thread Rolling Attachment . . . and available to manufacturers tooling machines for thread rolling.

It furnishes data to help reduce operating costs and produce high quality threads. With this booklet, setup men without previous thread rolling experience have successfully completed the setup for production.

REED Engineering Service . . .
- Complete Technical Information for the selection of equipment and tooling for your requirements.
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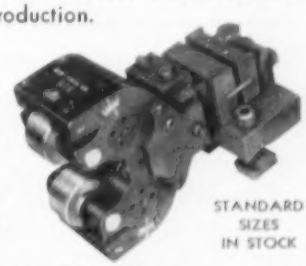

STANDARD SIZES IN STOCK

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REED ROLLED THREAD DIE CO.
Specialists in Thread and Form Rolling Tools and Equipment
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TRA101

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

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the occasion. The new plant increases Sterling's manufacturing facilities by more than three times.

v v v

A $33-million expansion program is under way for Lukens Steel Co. which, when completed, will boost the company's rated ingot capacity by nearly 25 percent or to more than 925,000 tons annually. Major facilities to be included in the expansion are a 100-ton electric furnace, new ingot and slab soaking pits and a four-high 140-in. breakdown mill. Construction is scheduled to be completed within two years.

A second construction program, separate from the expansion plan, involves a $1-million physical testing laboratory which should be in full operation within 12 months.

v v v

Some $1,600,000 for expansion and modernization of five foundry sites will be spent this year by General Electric's Foundry Dept. The largest amount, almost a million dollars, will be invested in the Schenectady area where, among other work, a 100-ft long, 60-ft wide extension is being built onto the present steel foundry.

v v v

An addition of more than 10,000 sq ft of manufacturing space has been put into operation at the Aurora, Ill. facilities of Milford Rivet & Machine Co. The new structure was built as a wing to the existing plant.

v v v

Size of Burroughs Corp.'s Tireman Ave. plant in Detroit will be more than doubled with completion of a second manufacturing building. The plant is one of Burroughs' major facilities for production of electronic equipment.

v v v

To provide additional engineering facilities and allied research development has prompted a $600,000 expansion program for Parker Appliance Co. The new structure, which is an addition to the present facilities in Los Angeles, will be completed by July 1.

v v v

Major plant expansion planned by Moore Special Tool Co., Inc. will provide the company with a 74,600 sq ft two-story building adjoining the present plant and allow a 50 percent increase in machine tool production.

anniversary

Fiftieth anniversary of its founding is being celebrated by Schauer Mfg. Corp. Possibly the company's major contribution to industry was the introduction in 1929 of the speed lathe to American mass production.

production notes

To provide emergency packages primarily to meet maintenance requirements, Bearings, Inc., are now marketing the No. 1 O-Ring Kit containing 166 O-rings in 20 different sizes. Sizes have been selected from most commonly used in industry. Interchange information on all nationally known makes is included.

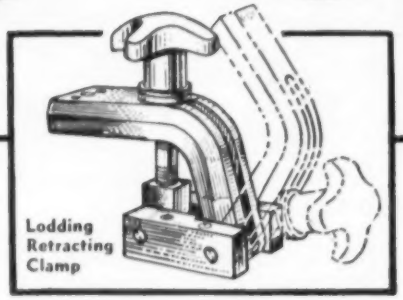
v v v

Line of cutting tools made by Fastcut Tool Co. has been expanded to include high-speed end mills up to ½ in. diam.

v v v

S. W. Card Div. of Union Twist Drill Co. has added taps for use in cast iron and brass to its line of tools. These items, list number 3037, are available

You Cannot Afford To Make Your Own



Standardized Components that a toolmaker would take hours or days to make, are ready for you at your Lodding distributor.

Four sizes each of four styles — hand knob, hand cam, nut and air operated.

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from stock from ¼ to ½ in. in coarse pitches, made to the standard G H3 limits, in taper, plug and bottoming styles.

v v v

Addition of two C Groove adjustable speed drives to its line of standard drives has been announced by The American Pulley Co. The new drives permit stepless speed adjustment up to 26 percent.

v v v

Detroit Tap & Tool Co. has added carbide plug and thread gages to its line of chrome-cobalt steel threading tools and gages.

new publications

A new quarterly magazine is being published by Elwell-Parker Electric Co. First issue of the *Elpar Lift for Industry* highlighted an article on preventive maintenance for industrial trucks and included work charts which may be used for such programs. Copies may be obtained from the company, 4205 St. Clair Ave., Cleveland 3, Ohio.

v v v

Promat Div. of Poor & Co. is initiating the publication of a controlled circulation, monthly magazine named *Promat's Progress* which will be sent to persons in the metal finishing field who are interested in hot-dip, electroplating and electrogalvanization processes.

sales

Complete tool line made by Hunter Tools has been made available in Canada through the Len Finkler organization of Toronto.

v v v

Vascoloy-Ramet Corp. has opened a Branch office at 1514 N. Pennsylvania Ave., Indianapolis, Ind. to provide better service and delivery of products.

v v v

Two new sales and service offices for Burg Tool Mfg. Co., Inc., have been set up with the establishment of Burgmaster Ohio Sales Div., 14706 Detroit Ave., Cleveland, and Burgmaster Michigan Sales Div., 13730 W. Eight Mile Rd., Detroit.

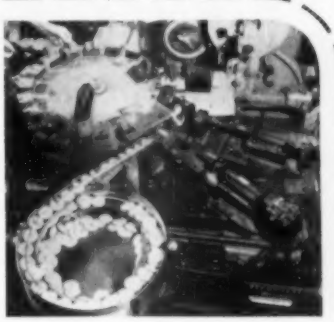
v v v

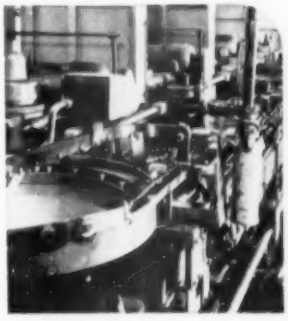
A Los Angeles sales office has been established by Riverside-Alloy Metal Div. of H. K. Porter Co., Inc. The office, at 6424 E. Fleet St., is headed by John L. Merrill, district manager for the West Coast sales territory.

Convert a monotonous manual task into an automatic operation - - with

SYNTRON

PARTS FEEDERS





If you want automatic, oriented position and single line feeding of small parts — SYNTRON PARTS FEEDERS will do that and, at the same time increase production and eliminate the time and costs involved in manual feeding.

Rate of parts flow can be controlled by merely turning a dial to increase or decrease the rate of flow of parts discharge.

They emphatically increase the speed and accuracy of any production operation. Almost every kind of material may be handled—metal, wood, plastic, rubber, ceramic, glass, etc.

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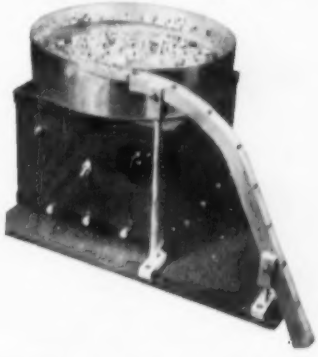

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Other SYNTRON Equipment of proven Dependable Quality

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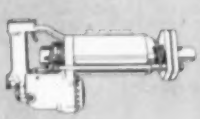

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technical Shorts

As little as 0.0001 in. of paint film electroplating or metal overlay can be measured by a new quality control instrument developed by General Motors Research Staff. This nondestructive tester, called the Laminagage, can be used for a high rate of production inspection by an operator who has had no special training in its use. According to its developers, the device has been used successfully to measure thickness of paint on aluminum, nickel electroplate on steel, copper electroplate on steel and babbit bearing overlay on bronze.

Nondestructive Tester Measures Thinnest Films

Basically the instrument consists of a small metal cabinet containing electronic equipment and a probing coil connected by coaxial cable with the cabinet. The probing coil is used to contact the part under test, and it can be designed for probing parts of virtually any shape. When the probing coil contacts the part under test, the thickness of the paint film or plating overlay on the part instantly registers on a large dial located on the front of the cabinet. If the dial needle ranges between certain calibrated points, the part is up to standard. Otherwise it is rejected.

The Laminagage utilizes the principle that distribution of an alternating electric current in an electrically conducting material is greatest at the surface and decreases as it penetrates beneath the surface. The rate at which the current decreases beneath the surface depends on how readily a substance can be magnetized and how readily it conducts electricity and the frequence of the alternating electric current.

The instrument is portable and can be plugged into any 110-v outlet.

* * *

Possibility of replacing metal in many applications now appears with the discovery and initial development of a tough new plastic material by General Electric Co. According to report, parts made from the compound, Lexan polycarbonate resin, are strong enough to withstand blows from a hammer. The combination of toughness, impact strength, heat resistance and dimensional stability provided by Lexan resin makes it a promising material for applications not previously handled by conventional thermoplastic materials.

Strong Plastic May Provide Metal Substitute

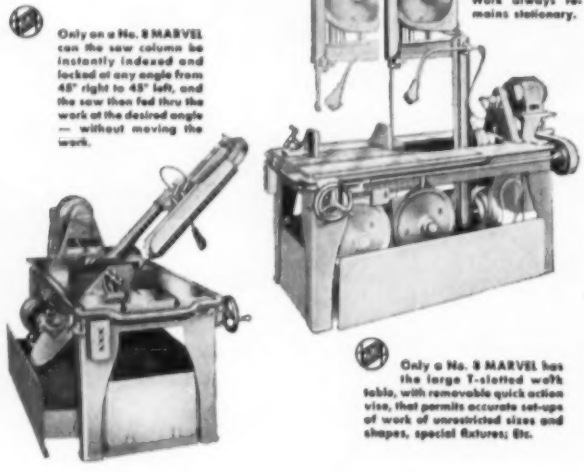
Currently it is being made in small lots at G-E's applied research laboratory at Pittsfield, and all available material is going into the company's testing program, where it is being evaluated in the form of molding, compound, extrusion compound, film, varnish and coatings.

Early study indicates that Lexan resin can be made in a variety of transparent or opaque colors, with parts showing good surface hardness and gloss. The good electrical characteristics, high thermal stability, low water absorption and high tensile strength of Lexan film give evidence of suitability for use as electrical and insulating material.

Until present evaluations have been completed and pilot plant production established, samples will not be available for general distribution.

Never Confuse the No. 8 MARVEL with an ordinary Band Saw

...only the MARVEL is Universal



Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.

Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.

Only a No. 8 MARVEL can do all of these things: Snip-off a ½" rod or cut-off an 18" x 18" cross section.

Rough to Size and Shape

Miter

Index

cut off and shape Structural Beams

Slotting

Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; etc.

"Rough Machine" to size and shape with minimun chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.

Metal Cutting MARVEL SAWS — Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

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Trade Literature

for free booklets and catalogs—use convenient request card, page 169

Porcelain Enamel

Cartoon-illustrated, 20-page booklet, "Porcelain Enamel in Industry," deals with origin and development of the technique, its advantages and important features; describes common uses and special applications; also outlines company's ability to design and fabricate porcelain enameled parts. The Erie Ceramic Arts Co., Dept. 3147, 3120 W. 22nd St., Erie, Pa. **L-6-1**

Steel

Four-page technical data sheet, "Allegheny Ludlum Stainless Steel Type 201," gives detailed information on this chromium, nickel manganese stainless steel; covers analysis range, resistance to corrosion, resistance to oxidation, physical properties and mechanical properties; welding characteristics and fabrication data and suggests typical applications. Adv. Dept., Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa. **L-6-2**

Zirconium

A bimonthly brochure, "More Zr Facts," is now available to acquaint industry with the commercial application possibilities, technical data and other pertinent facts on zirconium. Issues cover such points as historical data, corrosion resistance, nuclear properties, physical and mechanical properties, analytical methods and fabrication techniques. No. 1 and 2 of Vol. I are currently available. The Carborundum Co., Niagara Falls, N. Y. **L-6-3**

Honing

Barnesdril. Honing Handbook, Catalog No. 500G, describes how honing generates diametrically round and straight bores, automatically controlling size and producing preselected degree of finish; includes tables and charts for proper speed selection for specific finishes in various materials; gives instructions for calculating work stroke for maximum honing efficiency; describes requirements for various honing applications, and analyzes difficult bores for production finishing. Also covers abrasive grades and grits and gives analysis and effects of various types of cutting fluids. Barnes Drill Co., Rockford, Ill. **L-6-4**

Jig and Fixture Templates

Tracing templates offered in four page folder; condensed to include more than 200 components for jigs and fixtures in full scale. Northwestern Tool & Engineering Co., 122 Hollier Ave., Dayton 3, Ohio **L-6-5**

Taper Drives

Engineering bulletin sheets Nos. 213 and 213-A, File E-2, contain standardized dimensions for all sizes National spline-taper drives from No. 00 to No. 50 inclusive. National Twist Drill & Tool Co., Rochester, Mich. **L-6-6**

Last word in capacity, accuracy and speed!

KNIGHT'S NEW No. 60
VERSATILE VERTICAL
for
PRECISION
BORING & MILLING

Unusual Extra Capacity. 18" cross feed—30" vertical travel

Rugged Bed-Type Table. Has 3-way bearing. Bed 36" wide; saddle 46" long

Convenient, Simple Operation. Longitudinal hand-wheel in front; easily moved counterbalanced spindle and spindle head.

Choice Of 3 Measuring Methods. Hardened and ground precision screws—locating counters—dial indicator equipment

Many Other Exclusive Features. Mail coupon today for complete information

TWO TABLE SIZES
18" x 52"— 28" longitudinal travel
18" x 60"— 36" longitudinal travel

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NEW

Buck

BORING BAR

Gives you new precision, speed, and economy

(A) Shows why the Buck is more rigid and stronger. Full shank of cutter is supported by bar, locked in by three screws.

(B) Shows adjusting screw behind cutter at end of bar. Provides adjustment to tolerances as precise as machine permits — even on 1" bars.

There are 30 sizes of Buck Boring Bars ranging in boring capacities from a minimum of $^{25}/_{32}$" to a maximum of 6¼".

The rigidity for heavier, faster cuts — plus precision adjustment to tenths — is now available with the Buck.

You can spot the design advantages. Cutter is "out front." Provides ample chip clearance. Permits use of bigger shank for greater strength and rigidity.

The Buck uses standard cutters. Cutting edges are always on center — means less, and sometimes no, tip grinding. This, plus super rigidity, means longer cutter wear and permits using the better grade of carbide tools.

This just begins to list the many features. Write for complete details.

BUCK TOOL COMPANY

633 SCHIPPERS LANE, KALAMAZOO, MICHIGAN

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NEED SPECIAL *TOOLING?*

Total working time for this accurate, low-cost, durable drill jig — just 35 minutes.

Make complicated jigs, fixtures and holding devices in MINUTES with DEVCON

THE PLASTIC STEEL®

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DEVCON makes a precision form of the original part . . . without shrinkage or distortion. Handles like modeling clay . . . hardens to strong, tough metallic piece. DEVCON can be sawed, tapped or ground with metal-working tools. It has extreme strength, excellent adherence to most materials, will not rust or corrode.

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Bearings

Nonlubricated bearings made from carbon-graphite material described in 12-page, illustrated catalog; covers properties, load rating charts, standard grade and application data sheets, and describes actual operations where these bearings are being used. Electro-Nite Carbon Co., 8601 Torresdale Ave., Philadelphia 36, Pa. **L-6-7**

Gearing

Twelve-page illustrated booklet, B-7012, "Industrial Gearing," outlines design facilities and manufacturing capacity of company's gearing division for producing custom-made gearing. Westinghouse Electric Corp., P.O. Box 2278, Pittsburgh 30, Pa. **L-6-8**

V-Belts

Tips on how to obtain longer V-belt life and increase drive efficiency presented in 12-page Bulletin 20X6234C, "Longer Belt Life For Your V-Belt Drives"; describes various types of V-belts and tells how to select and match them; also gives installation suggestions. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis **L-6-9**

Machine Tools

Entire line of precision machine tools, including engine, toolroom and turret lathes, milling machines, shapers, drill presses and tool grinders plus accessories, described and illustrated in 80-page Catalog No. 5700. Includes specifications and price lists. South Bend Lathe Works, South Bend 22, Ind. **L-6-10**

Hardening Stainless

Information gained from continuing study on 17-4ph precipitation hardening stainless steel presented in illustrated "Esco Alloy Notebook No. 5"; includes compilation of mechanical properties after hardening for both cast and wrought samples; also gives mechanical properties of cast 17 4ph in the as-cast and annealed conditions. Electric Steel Foundry Co., 2141 N. W. 25th Ave., Portland 10, Ore. **L-6-11**

Metalworking Machinery

Extensively illustrated, 68-page Catalog No. 26, "Metal Working Machinery" describes variety of shop equipment and supplies with special emphasis on requirements of small and medium size metal fabricators. Covers bending, grinding, punching, shearing, sawing, welding, forging, drilling, tapping, threading, notching, materials handling. Julius Blum & Co., Inc., Carlstadt, N. J. **L-6-12**

Testing Penetrants

Manual presents data on fluorescent penetrant materials and fluorescent penetrant testing; offers information helpful in selecting and controlling the best test for each usage; extensively illustrated. Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill.
L-6-13

Silicon

Twenty-page monograph, "The Relationship of Silicon and Its Properties To the Electronics Industry" by Dr. Donald R. Mason, describes characteristics of silicon in rectifiers, solar batteries, transistors, etc. and the method of device fabrication. Aries Laboratories, Inc., 41 E. 42nd St., New York 17, N. Y.
L-6-14

Measuring Instruments

Set of bulletins discusses recently developed series of sensitive accelerometers and a cathode follower designed to meet laboratory and field requirements for shock and vibration studies encountered in missile work, nuclear detonations, airborne applications, transient structural loads, package drops and other tests. Columbia Research Laboratories, MacDade Blvd. and Bullens Lane, Woodlyn, Pa. **L-6-15**

Lubrication

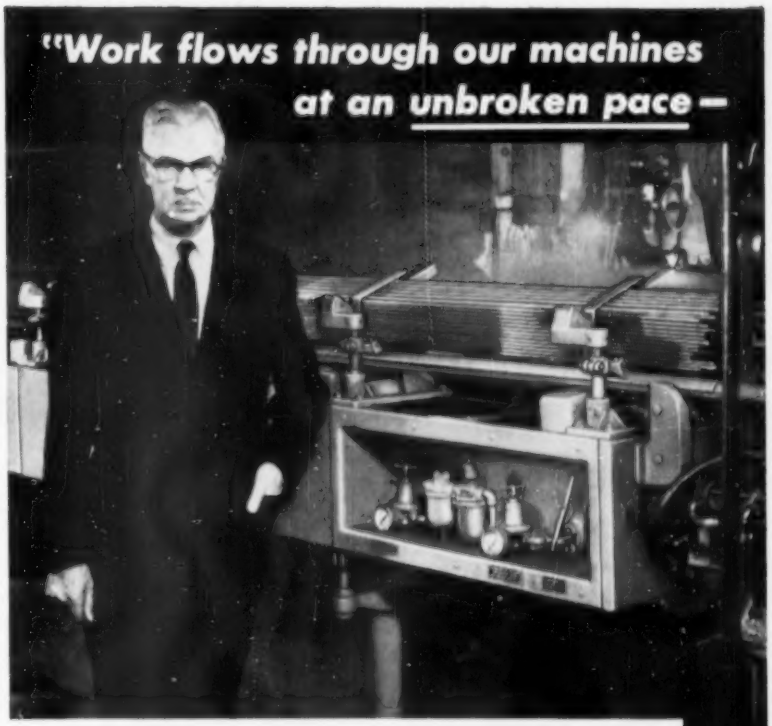
Technical paper on the measurement of surface temperatures under sliding friction by a thin thermocouple technique presented in *Lubrication Newsletter*, Vol. 1, No. 2; discusses development of method for such measurement, outlines test setup and experimental procedure and results. The Alpha Molykote Corp., 65 Harvard Ave., Stamford, Conn. **L-6-16**

Collets

Drawings and photos illustrate 24-page Catalog No. 22 covering line of collets and feeders. Each model is shown in cross-section views and described with price lists and ordering instructions. Also contains helpful information for solution of collet and feeder problems. Sutton Tool Co., Sturgis, Mich. **L-6-17**

Press Brakes

Advanced design of series A, B, C and L Chicago press brakes discussed in illustrated 16-page Catalog AL-57; covers construction features and gives specifications of different size units. Brochure also gives information on induction hardened dies for all makes of press brakes. Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
L-6-18



with **LIPE Automatic**
MAGAZINE LOADING BAR FEEDS"

says Factory Superintendent Dan Thomas*

Our production figures ran all over the chart when we were using stock-feeding devices equipped with feed-fingers. In addition to tricky set-ups and frequent re-sets, we lost a lot of polished stock which had to be scrapped or refinished when scratched or marred by feed-fingers. Operators suffered fatigue and strain trying to stay on top of these mechanical "prima donnas." Production suffered from the slow-downs resulting from all these factors.

Our first test run of a Lipe A.M.L. Bar Feed proved that every one of these "bugs" could be eliminated—permanently. It fed stock continuously . . . without feed-fingers . . . with no repeat motion for feed-outs . . . no down-time for adjustments or remnant removal. There was no cutting air: From 7:30 to 4:00 every turn of the spindles produced *work* . . . at a day-in-day-out delivery of 58% higher production! Our entire department is now equipped with Lipe A.M.L. Bar Feeds.

WRITE or WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe A.M.L. Bar Feeds in your production layout.

*Photographer's models and pseudonyms used to protect company identity and confidential information.

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N. Y.

BAR FEEDS • HEAVY-DUTY AUTOMOTIVE CLUTCHES • PORTABLE POWER HACK SAWS

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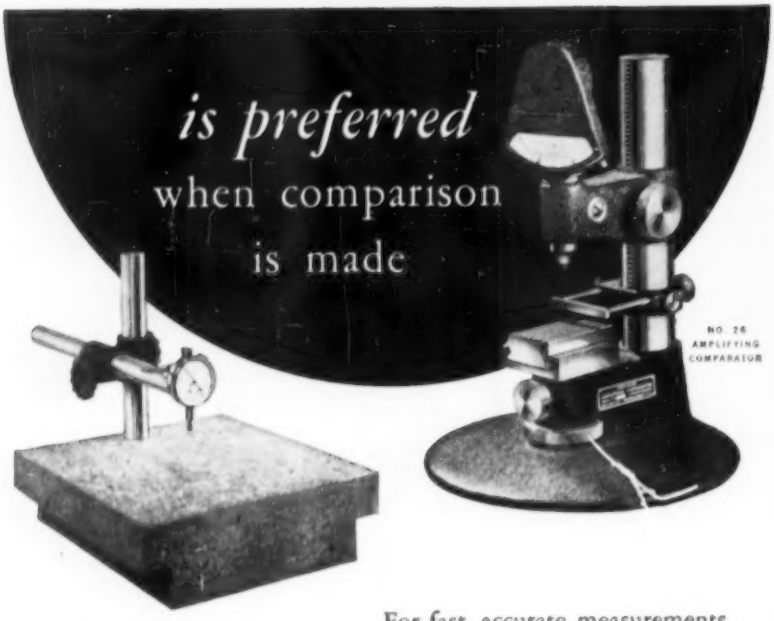
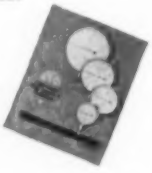
when comparison
is made



MODEL 130 GP.

For fast, accurate measurements, Ames Dial Comparators are the choice of quality control men everywhere. You get definite, impersonal readings directly from the dial. There's no guesswork or figuring.

Special comparators are available for measuring resilient materials such as rubber, paper, etc., and for measuring non-yielding materials such as sheet metal, glass and plastic. Write for complete details.



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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-196

Drills and Reamers

Technical data of using, sharpening and handling of drills and reamers of high-speed and carbide steel presented in illustrated 22-page booklet, "Care of Drills and Reamers;" graphs and charts help users to take maximum advantage of these tools. Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. **L-6-19**

Electromagnetic Controls

Illustrated catalogs provide extensive information on line of electromagnetic controls; all include technical data, application suggestions, specifications and prices. Available as one catalog, 75-S, or as separate individual sections. The entire package is made up of: Catalog 57-S1 covering mechanically or magnetically held automatic transfer switches designed to transfer a load from a normal source to an emergency source; Catalog 57-S2 covering mechanically held control switches; Catalog 57-S3 describing magnetically held contactors designed to allow unlimited combinations, including multipole, special contact arrangements and materials and other engineered-to-fit features; Catalog 57-S4, describing line of relays available in either magnetically or mechanically held types as well as line of special purpose relays; Catalog 57-S5, covering a-c and d-c solenoids. Request only on company letterhead direct from Automatic Switch Co., Florham Park, N. J.

Metal Removal

Brochure, "Maximum Automation Potential," explains company's recently established free engineering service devised to predict performance of abrasive belts on any metal removal operation except snagging operations. The Carborundum Co., Niagara Falls, N. Y. **L-6-20**

Use of Research

Extensively illustrated 24-page Bulletin S-1053, "An Approach to Interpretive Research," describes company's laboratory facilities available for contract research; discusses investigations that bridge gaps between basic theory and practical application explains importance of such work. Selas Corp. of America, Dresher, Pa. **L-6-21**

Speed Reducers

Catalog SCD-57 covers line of shaft mounted Screw-King speed reducers designed for screw conveyor application; includes helpful aids for selection of drives for this use. The American Pulley Co., 4201 Wissahickon Ave., Philadelphia 29, Pa. **L-6-22**

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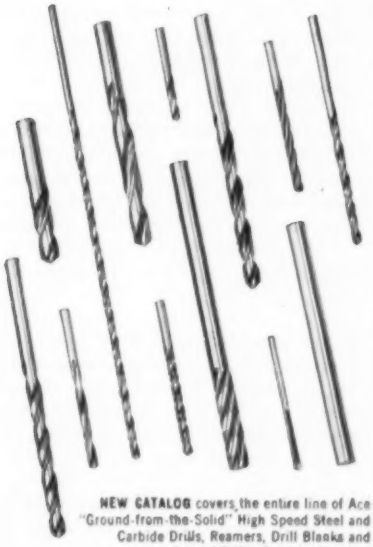

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INDICATE A-6-197-1

who's meeting and where

June 5-7. Bureau of Apprenticeship and Training, U. S. Department of Labor. Eastern Seaboard Apprenticeship conference, Marshall House, York Harbor, Me. Cooperating states include Maine, Vermont, New Hampshire, Connecticut, Massachusetts and New York. Write to Maine Apprenticeship Council, Dept. of Labor and Industry, Augusta, Me., for more data.

June 5-8. National Society of Professional Engineers. Annual meeting, Statler-Hilton Hotel, Dallas, Texas. For details contact society office 2029 K St., N.W., Washington 6, D. C.

June 5-14. Washington University, Department of Industrial Engineers and the Society for Advancement of Management. Annual intensive course in Motion and Time Study. For more information write to Washington University, University College, St. Louis 5, Mo.

June 9-14. The American Society of Mechanical Engineers. Semiannual meeting, Sheraton-Palace, San Francisco, Calif. Society office, 29 W. 39th St., New York 18, N.Y. can supply details.

June 9-14. The Pennsylvania State University. Third annual engineering seminar on automation for industry, University Park, Pa. For further information, contact Chester Linsky, assistant professor of industrial engineering. The Pennsylvania State University, University Park, Pa.

June 11-13. Western Plant Maintenance and Engineering Show, Civic Auditorium, San Francisco, Calif. Request details from exposition managers, Clapp and Poliak, Inc., 759 Monadnock Bldg., San Francisco 5, Calif.

June 11-14. Cornell University. Annual Industrial engineering seminars sponsored by Dept. of Industrial and

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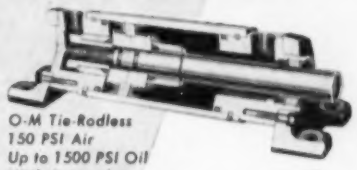

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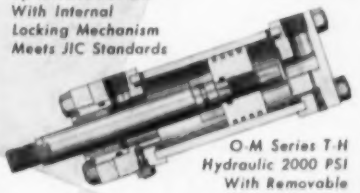

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Engineering Administration, Sibley School of Mechanical Engineering, Cornell University. Pertinent information may be obtained from Andrew Schultz, Jr., Dept. of Industrial and Engineering Administration, Cornell University, Ithaca, N.Y.

June 12-14. Illinois Institute of Technology. Operations Research conference, IIT campus, Chicago, Ill. Forward inquiries to Conference Coordinator Raymond D. Meade, Illinois Institue of Technology, 3300 S. Federal St., Chicago 16, Ill.

June 13-14. The Society of Plastics Industry, Inc., Midwest plastics conference Arlington Hotel, Hot Springs National Park, Arknsas. Obtain more facts from society headquarters, 250 Park Ave., New York 17, N.Y.

June 13-15. Instrument Society of America. Third national symposium on instrumental methods of analysis, University of Chicago, Chicago, Ill. Advance programs and registration information are available from H. S. Kindler, director of technical programs, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

June 14. Pressed Metal Institute. National sales conference for metal stampers, Hotel Carter, Cleveland, Ohio. More data is available from institute office, 3673 Lee Rd., Cleveland 20, Ohio.

June 14. Society of Plastics Engineers, Inc. Regional technical conference on "Plastics for Electronics," Lowell Institute of Technology, Lowell, Mass. Direct inquries to Ralph Mondano, Raytheon Mfg. Co., Foundry Ave., Waltham, Mass.

June 16-21. The Pennsylvania State University. Fourth annual seminar in creative engineering. Further information may be obtained from seminar chairman, Maurice Gjesdahl, professor of mechanical engineering, The Pennsylvania State University, University Park, Pa.

June 16-21. American Society for Testing Materials. 60th annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Request details from society headquarters, 1916 Race St., Philadelphia 3, Pa.

June 17-21. The American Society for Engineering Education. 65th annual meeting, Cornell University, Ithaca, N.Y. More data may be obtained from Arthur J. McNair, School of Civil Engineering, Cornell University, Ithaca, N.Y.

June 17-28. Massachusetts Institute of Technology. Special summer pro-

gram in wear theory in metal cutting and bearing design offered by the Metals Processing Div. of the Dept. of Mechanical Engineering. Request details from John I. Mattill, Assistant to the Director of Public Relations, M.I.T., Cambridge 39, Mass.

June 23-28. NATIONAL ASSOCIATION OF POWER ENGINEERS. National convention, Pantlind Hotel, Grand Rapids, Mich. Write to Edward J. Schuetz, secretary of NAPE, 176 W. Adams St., Chicago 3, Ill. for more facts.

June 27-28. CONFERENCE ON POWDER METALLURGY, Dusseldorf, Germany. Request more information from Geschaftsfuhrung des Ausschusses für Pulvermetallurgie, Düsseldorf, Breite Strasse 27, Germany.

July 16-19. BUREAU OF APPRENTICESHIP AND TRAINING, U.S. Dept. of Labor. Meeting planned by middle atlantic states apprenticeship conference committee, McLure Hotel, Wheeling, W. Va. Write to Walter Seabright, Seabright Construction Co., Wheeling, W. Va., for more information.

July 18-20. BUREAU OF APPRENTICESHIP AND TRAINING, U.S. Dept. of Labor. 9th annual southern states apprenticeship conference, Rice Hotel, Houston, Texas. For more data contact J. Walter Jones, Jr., Wessel Construction Co., Memphis, Tenn.

July 29-Aug. 2 and Aug. 5-9. WESTERN RESERVE UNIVERSITY, School of Library Science in cooperation with Cleveland Public Library and Special Libraries Association. Special summer seminars designed for those interested in effective management of recorded information. Direct inquiries to Jesse H. Shera, dean, School of Library Science, Western Reserve University, 11161 East Blvd., Cleveland 6, Ohio.

Aug. 11-15. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Heat transfer conference, Pennsylvania State University, University Park, Pa. For more data, contact society office, 29 W. 39th St., New York 18, N.Y.

Aug. 12-15. SOCIETY OF AUTOMOTIVE ENGINEERS. West coast meeting, Olympic Hotel, Seattle, Wash. Direct inquiries to Bruce E. Strasser, SAE Public Relations manager, 485 Lexington Ave., New York 17, N.Y.

Aug. 20-23. WESTERN ELECTRONIC SHOW AND CONVENTION, Cow Palace Auditorium, San Francisco, Calif. For details write Donald E. Larson, Business manager, WESCON, 342 N. LaBrea Ave., Los Angeles, Calif.

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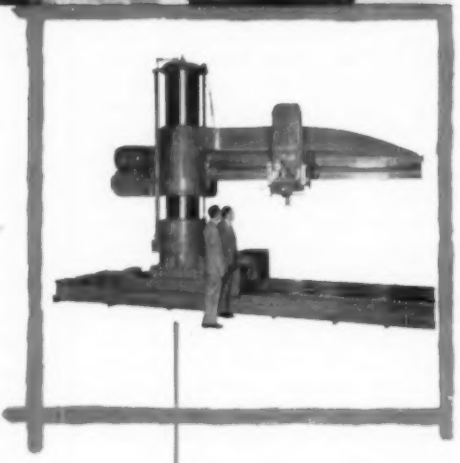

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SPECIALISTS IN RADIAL DRILLS

Men at Work

Arthur T. West (left) is new president of National Tool Co. and R. D. Lindstrom (right) was elected vice-president and general manager. Mr. West previously was secretary-treasurer of the company. Mr. Lindstrom was factory superintendent and vice-president of manufacturing.

Announcement from Copeland Refrigeration Corp. made public the appointment of **Merle W. McLaughlin** as vice-president in charge of manufacturing. Prior to joining Copeland, he was general manager of the Traverse City, Mich. division of the F. J. Jacobs Co.

New president and chief executive officer of Cavitron Equipment Corp. is **Carleton Ellis, Jr.** who previously was director of sales of plastics and resins for the Barrett division of Allied Chemical & Dye Corp. Mr. Ellis succeeds **Arthur Kuris** who has been president since the company's formation in 1947 and now becomes chairman of the board.

Arthur S. Nippes is new vice-president and general manager of the Henry Disston Div. of H. K. Porter Co., Inc. He formerly was associated with the Elliott Co.

A. Lyndon Foscue, Birny Mason, Jr. and **Edwin B. Suydam** have been elected vice-presidents and appointed members of the appropriations committee of Union Carbide Corp. Associated with Union Carbide since 1924, Mr. Foscue has been president of its Electro Metallurgical Co. since 1953, and president of Haynes Stellite Co. since 1954. Mr. Mason, a veteran of 25 years with Union Carbide, is secretary of the corporation and president of its Union Carbide Development Co. division. Mr. Suydam, who joined Union Carbide in 1916, has been president of Linde Co. for the past two years.

Recently created position of production manager of the Spring Div. of Crucible Steel Co. of America has been filled by the appointment of **Charles W. Darby.** He will be responsible for all production, quality control and maintenance activities of the division.

W. W. Lampkin, director of manufacturing for the Aircraft Div. of Hughes Tool Co., has been elected national chairman of the Aircraft Industries Assn.'s manufacturing committee. Named as vice-chairman was **G. T. Willey,** vice-president-manufacturing for The Glenn L. Martin Co.

Hubert J. Pessl has been named director of research and education for Verson Allsteel Press Co. During the past two years, Dr. Pessl has served as a consultant for Verson's research and development center. Until recently he was director of shell engineering and research for Gibson Refrigeration Co.

Frank M. Mansfield III has been named sales manager and vice-president for Wagner Brothers, Inc. He formerly was manager of product planning and market research for General Electric's Metallurgical Products Dept.

New officers of the American Welding Society elected at the recent annual meeting are **Clarence P. Sander,** president, and **Gustav O. Hoglund** and **Charles I. MacGuffie,** first and second vice-presidents respectively. Mr. Sander is general superintendent of the Vernon plant of the Consolidated Western Steel Div., United States Steel Corp. Mr. Hoglund is head, Welding Section of Alcoa Process Development Laboratory. Mr. MacGuffie is manager of marketing, Welding Dept., General Electric Co.

Dana B. Jefferson Jr., partner of Walker Mfg. Co., has been elected president of the National Screw Machine Products Association.

H. J. Louth is now works manager of The Ohio Crankshaft Co.'s Crankshaft and Camshaft Div. He has been with the firm since 1942.

E. C. Wilson was elected vice-president of Illinois Gear & Machine Co. He has been associated with the company for 15 years.

Walter H. Feldmann is now president of Worthington Corp. succeeding Edwin J. Schwanhausser who became vice-chairman of the board.

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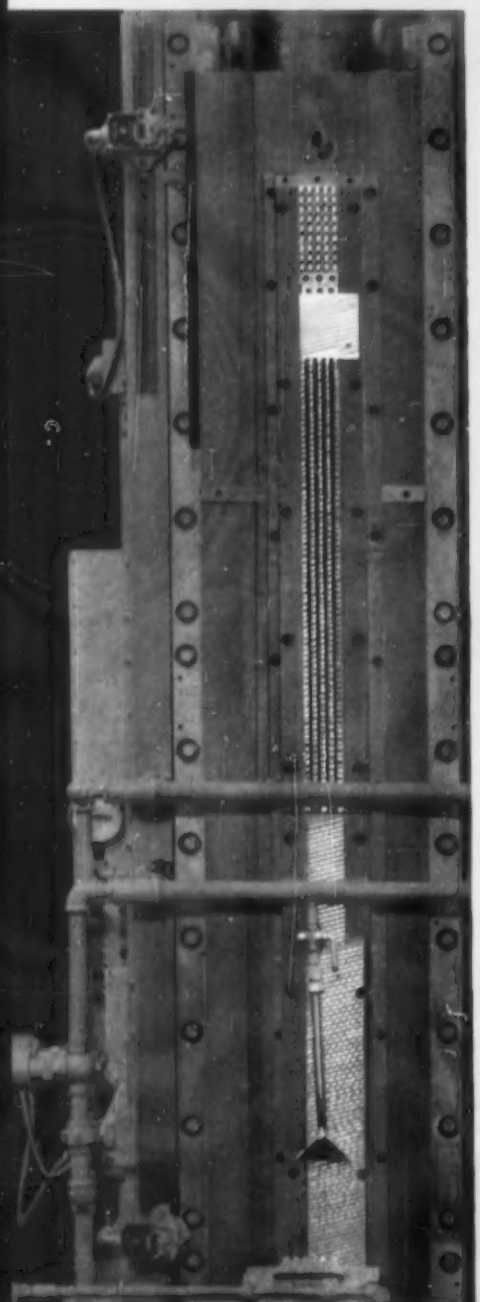

It goes without saying, that you must start with good steel, give it proper heat treatment, grind the form to the exacting requirements and close tolerances of the drawing.

But WHO engineers the data on the drawing? Is it someone with long experience, devoting his entire time to broach-engineering? Lapointe engineers have had many years of background in designing broaches. Most of these men have spent 20 to 35 years with us. That sounds like a pretty good guarantee that the

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J. Richard Garvin was named manager of manufacturing at the General Electric Co's Specialty Transformer Dept. He succeeds **Richard J. Keyser** who was assigned to the Manufacturing Services Div. as consultant on shop operation. Mr. Garvin has been superintendent of jet engine assembly at the company's Aircraft Gas Turbine Dept.

Emerson L. Claussen is now vice-president in charge of standard products sales of Standard Screw Co. Associated with the firm for 30 years, Mr. Claussen has been sales manager in charge of standard products for The Chicago Screw Co. division of the organization.

S. D. Strauss, vice-president and manager of sales for American Smelting and Refining Co., is now president of the American Zinc Institute. Three vice-presidents elected at the same time include **J. D. Bradley** of The Bunker Hill Co., Clarence Glass of Anaconda Sales Co. and H. L. Young of American Zinc Sales Co.

James K. Wingard is manager of engineering of the press division of the E. W. Bliss Co. Associated with Bliss for 20 years, Mr. Wingard has been assistant chief engineer of its rolling mill division since 1953.

The U. S. Hoffman Machinery Corp. has announced appointment of **Raymond Boyd, Jr.** as manager of the industrial divisions and foreign operation. He previously was manager of the air appliance department of the industrial divisions, a post now filled by **Lewis S. List.**

Jarvis Corp. has appointed **Ernest F. Dooley** as carbide tool engineer. He has been active in the field since 1943.

Lipe-Rollway Corp. has announced appointment of **Robert M. Zimmer** to the post of general manager of the company. He has been assistant general manager since joining the firm a year ago.

Former chief engineer of Cargill Detroit Corp., **Avrel Mason** has now been made general manager of a new division formed to handle engineering, manufacturing and sales on all automatic gaging and size controls. He is succeeded in his former post by **Belding H. McCurdy.**

Alvin Hamilton and **Harold Domingue** have joined the sales staff of Johnson-de Vou, Inc. Mr. Hamilton has been tool and methods engineer for the Rockwood Sprinkler Co. while Mr. Domingue has been customer and sales service representative for Johnson-de Vou's New England territory. Both men are members of ASTE's Worcester chapter.

CHILE	COLOMBIA	PERU	ARGENTINA
SPAIN	PORTUGAL	SO. AFRICA	SWEDEN
ISRAEL	JAPAN	BELGIUM	MEXICO
INDIA	AUSTRIA	BRAZIL	CANADA
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on Choice of Yoder Mills for Pipe and Tube Manufacture

It all started less than two decades ago with the introduction by Yoder—and the rapid adoption by American industry—of a revolutionary new type of mills for cold forming and electric-resistance welding of pipe and tubing. England, France, Italy, Mexico, Argentina, and Brazil soon followed the U.S.A. in adopting these mills. Other countries boasting any kind of modern metal working industry did likewise, even including distant Japan, India and South Africa. Production, depending on requirements, varies from 25,000 up to 75,000 feet per 8-hour shift.

•

By this time, England, Italy and Argentina each have a total of ten Yoder mills in operation; Brazil, eight; Mexico, six; France, five; other nations somewhat in proportion to their population. In many nations, Yoder mills now supply from 50% to 90% of all welded tubes used. Several outstanding production records have been scored by operators in foreign countries, most recently in Italy. Reasons: the simplicity of design, ease of operation and dependability of Yoder mills. Secondly, generous assistance rendered by Yoder in training operators everywhere.

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Through technological advances, Yoder leadership in tube mill design has been jealously maintained and strengthened from year to year. Ask for literature giving details of the latest improvements. Correspondence invited.

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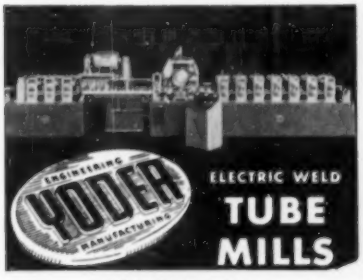

INDICATE A-6-203-1

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Automation in Germany

The human factor in automation is the subject of a study by H. Moll and W. Ulbricht. Their report is based on the plant of a German automobile manufacturer and appears in the March 1957 issue of *Werkstattstechnik und Maschinenbau*, pages 117-123. The title is "Heutiger Technischer Stand und Entwicklungs-tendenzen in der Automatisierung der Fertigung, am Beispiel einer Automobilfabrik."

The authors conceived the idea of measuring the effect of automation on the operator by establishing a physical and a psychological load factor. As an example, the factor one is assigned to either a purely physical or a purely psychological effort. The first one would be "get tools from the tool crib;" the second one, "read drawing." The factor measures the ratio of these two phases of any type of work. The sum of these factors compared with a work value for nonautomated basic functions is the load value for work at a given machine.

The maximum load found in the entire investigation was a value of 57.5 for the psychological effort for operating a hand lever of a turret. Automation is not limited to the concept of the transfer machine, but includes all types of machines. A turret lathe is defined as a 20 percent automated machine; a multicut lathe, as a 40 percent automated machine, etc.

The authors found that the physical and psychological effort or load drops with increasing automation of a single machine. If more than one machine is operated, the load factor increases again after dropping to a minimum at 67 percent automation. It remains less, however, than before automation. An engine lathe is 18.6 per cent automated without a tracer control attachment and 51.2 percent automated when such copying device is attached. Transfer machines are 90 percent automated.

Other chapters of the article deal with an investigation of the increase in

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INDICATE A-6-203-2

productivity, increase in capital investment and suggestions for development of machine tools. The authors conclude that automation has resulted in increased production and reduced physical and psychological effort of the operator.

Accuracy of Machine Tools

The distorting effect of thermal expansion in machine tools on the working accuracy can be effectively reduced by use of "Invar Bars" made of a material of a low coefficient of expansion. Motors attached to high accuracy machines, such as jig borers, transmit considerably less heat to the machine when these bars are employed instead of a cast-iron support. The principle is explained in an article by A. Mottu in *Werkstatt und Betrieb* No. 31957, pages 165-171. Full title is "Arbeitsgenauigkeit von Werkzeugmaschinen am Beispiel von Koordinatenbohr Maschinen."

The article deals with various problems involved in the accuracy of machine tools. Tests run by the author indicated that the heat of a motor built on top of the boring head of jig borers caused as much as 0.001-inch expansion within two hours. Such expansion is too great for precision work. By supporting the motor with invar bars, the expansion was reduced to one tenth of the previous value.

Daily temperature changes in the workshop, which are considerably less in Switzerland than in the United States, also affect working accuracy. It is particularly necessary to avoid sudden temperature changes or those of many degrees. The author believes that the thermal stability of a good jig borer would not be affected if the temperature change were not more than about 4 F within 24 hours. Strong air currents caused by draft or by nearby heaters in wintertime are the worst offenders.

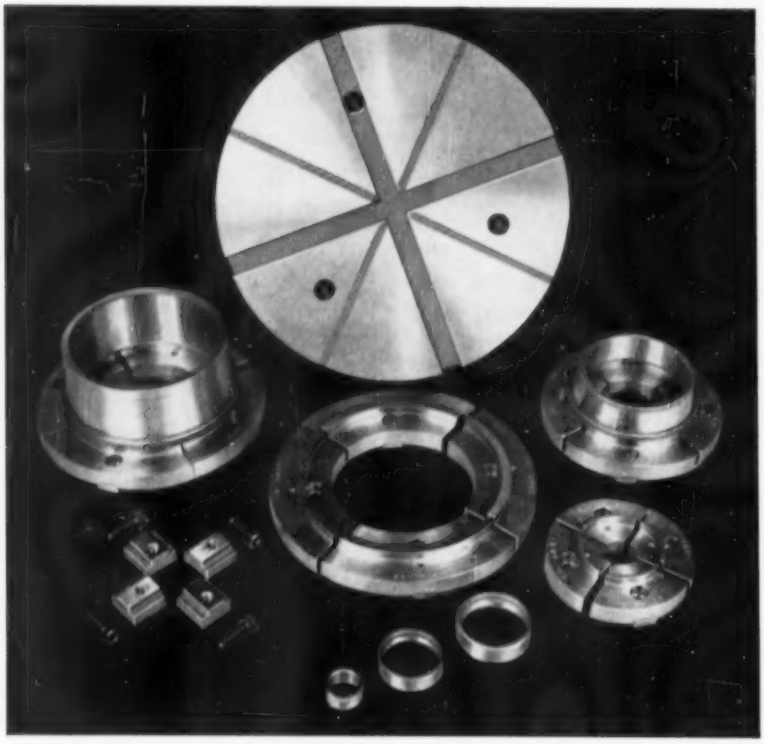
The author also discusses the effect of drilling forces on the working accuracy of jig borers. Single column machines deflect more than double housing machines due to the fact that the distance from the spindle to the column face is considerably longer on single-column machines. This results in deflections about 27 times as large as those encountered in double-housing jig borers. The length of the crossrails enters here, too.

Thermal expansion in the lead screws of machine tools is often a cause of inaccuracies. The author offers an equation for the temperature of a metallic body exposed to changing temperature in the open air, including area of contact, radiation and other factors. A lead screw of only 40-in. length and 2½-in. diameter expands as much as 0.023 in. if the room temperature increases from 40 to 90 F. Longer screws would expand correspondingly more.

The article also covers the effects of errors in the accuracy and straightness of guideways, the effect of changes in the oil-film thickness and many other factors.

Return to the Flat Belt?

A new type of belt drive is described by R. Brender in No. 2, 1957 of *Werkstatt und Betrieb*, pages 129-132, "Ruck Kehr zum Flachriemen, Eine Kritische Betrachtung der Frage: Flachriemen mit Spannrolle, Keilriemen oder selbstspannende Flachband Antriebe." The drive employs a flat belt in combination with an eccentrically supported motor. In this way it is possible to avoid the disadvantages of former flat-belt drives and to make the tension in the belt self-adjusting with the load, even when the center distances are short. The belt cannot slip due to the



Magnetic Work Drivers—

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WALKER engineers have designed a rotary magnetic chuck with a T-slot type 4-pole face plate upon which segmental magnetic drivers can be used. These drivers are key guided for in-and-out adjustment to cover large range of diameters; and are attached by T-nuts. The holding force can be varied by use of neutrolator from maximum strength to a degree to allow for slippage when used in conjunction with a shoe type support.

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fact that the tensions in the driven and driving portions of the belt can be regulated by the eccentricity so that their ratio is always less than the critical limit for slippage.

The author mentions places where such drives are used; among them are vertical boring mills, lathes and rolling mills. It is possible to use high ratios of transmission even when the center distances are short and the life of these belts is considerably improved. The bearings heat up less as the tensions and loads change with the power transmitted. It is also claimed that the belt drive is less likely to vibrate and flutter than other belt drives.

Automatic Control of Cutting Speeds

An electrical device developed in Russia is reported to vary spindle speed automatically with the hardness of the material and temperature at the cutting edge. The description is published by P. N. Malakhov in *Vestnic Mashinostroyenya* No. 4, 1955, pages 26-30 and is quoted by F. Wittekind in No. 2, 1957 of *Werkstatt und Betrieb*.

The unit consists of a measuring device, an amplifier and a servomechanism. A thermocouple formed by the cutting tool and the workpiece is used for deflecting a light beam which in turn operates photoelectric cells. One of these cells is for an increase in the spindle speed; the other, a decrease. It is also possible to have blue and red signal lamps light up, informing the operator that the workpiece is too hard for the respective speed or that the tool temperature is too high or too low, etc.

After experimentation, a unit was installed in a lathe in a workshop for cutting off railroad axles, using four tools simultaneously. The spindle rpm could be automatically adjusted between 1570 and 700. During 5 months of operation an increase in production of 25 percent was obtained.

Hardness Testing in Industry

Principal errors in hardness testing are due to inaccuracies in the indenters, work hardening of the materials being tested and build-up of walls around the indentation. This is discussed by A. Berger in *Industrie Anzeiger*, Vol. 78, pages 1541-2, December 28, 1956, under "Härteprufung im Betrieb." In microhardness tests hardness sometimes appears to increase at lower loads; therefore taking measurements on etched surfaces is suggested. The author discusses the relationship between the indentation and the size of the crystal. He recommends adjusting the load to particle size when the indentation is small. Several instruments are described for measuring microhardness.

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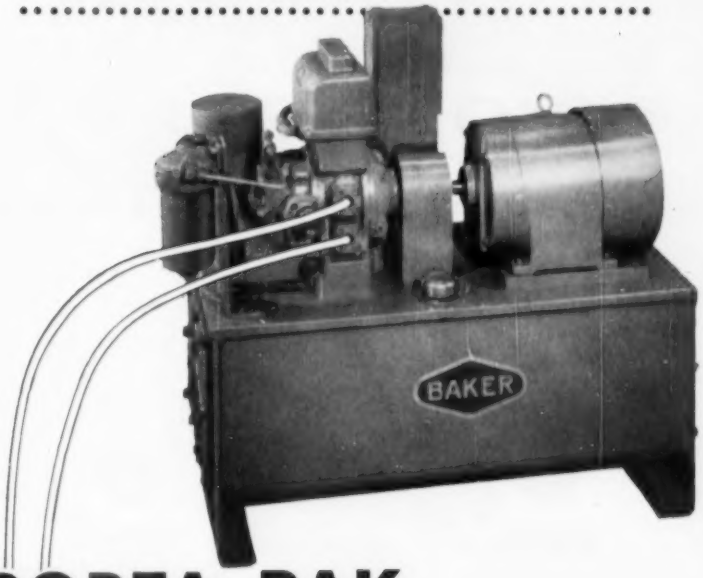

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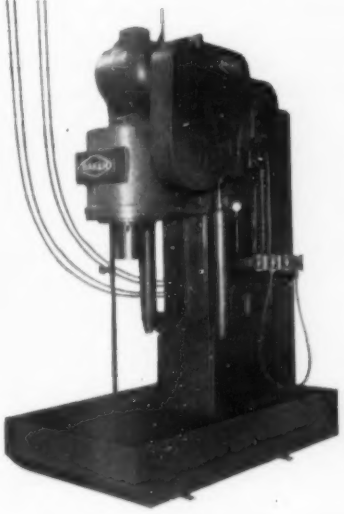

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good READING

DEFECTS AND FAILURES OF METALS: *Their Origin and Elimination—by E. P. Polushkin. Published by Elsevier Publishing Co., New York, N. Y. Distributed by D. Van Nostrand Co., Inc., New York, N. Y. Price $12.50. 399 pages.*

A detailed study of defects in metals, including segregation, blowholes and porosity, pipe, impurities, decarburization of steel, scaling, harmful effects of residual stresses in metals, fatigue, flakes, heat-treatment failures, embrittlement, cracks, wear and corrosion. An important summary for metallurgists; excellent background reading for others concerned with defects in metals.

ENGINEERING USES OF RUBBER — *by A. T. McPherson and Alexander Klemin. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $12.50. 498 pages.*

The late Dr. Klemin undertook the preparation of this book because, in his work on the design of aircraft, he needed information that was not readily available. He planned the book from the point of view of the engineer outside the rubber industry.

The book reveals why and how rubber is used rather than simply what it is used for, and shows how this information can solve special problems or develop new applications. Covering four major areas, the book paves the way for cooperation between engineer and manufacturer. Two chapters are devoted to the making of rubber goods; three chapters, to the properties and behavior of rubber; seven chapters, to applications in different industries, including tires and belt conveyors; and two chapters, to means of obtaining rubber products either by purchase or by special construction. A final brief chapter points out the relation between the new knowledge of the structure of polymers and their rubberlike properties, in order to give an indication that at some future date the engineering properties of rubber might be derived from molecular constants rather than from empirical measurement.

METAL CASTINGS — *by Joe L. Morris. Published by Prentice-Hall, Inc., 70 5th Ave., New York 11, N. Y. Price $7.35. 304 pages.*

Designed to present up-to-the-minute information in minimum reading time, this book emphasizes the principles of the subject. To keep the important points clear, routine discussions of procedural detail are omitted.

Discussed is the wide range of different methods of making castings—the technological control of raw materials and end products—material on the designing of castings and plant mechanization. Wherever possible, sketches and schematics are used rather than photographs, because they can more clearly convey the most basic information.

ABRACS OR NOMOGRAMS — *by A. Giet. Published by Philosophical Library Inc., 15 E. 40th St., New York 16, N. Y. Price $12.00. 235 pages.*

Most engineers have made use of nomograms at some time in their careers. They are a very convenient tool when the same formula has to be solved repeatedly for several sets of variables. However, only a few who use monograms know how to construct them for their own use.

This book is essentially practical, and not only demonstrates the many and varied applications of monograms, but shows how even those without specialized mathematical knowledge may construct their own charts. It deals with both cartesian abracs and alignment charts, and contains a large number of practical examples drawn from the fields of mechanics, physics and electrical engineering.

Very few formulas are outside the scope of nomograms if skillfully chosen auxiliary variables are chosen.

The subject is presented in an elementary way, intended for practical engineers rather than mathematicians.

MECHANICAL DESIGN FOR ELECTRONICS PRODUCTION — *by John M. Carroll. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 36, N. Y. Price $4. 368 pages.*

This book encompasses the problems that arise in designing and manufacturing equipment using electron tubes and transistors with the exception of the design of electronic circuits.

Chapter layout follows the steps of the designer in translating an aggregation of breadboard circuits to an item of finished equipment sufficiently ragged to withstand its intended enviroment and capable of being manufactured at minimum cost.

The book is intended primarily for working engineers seeking help of a practical nature.

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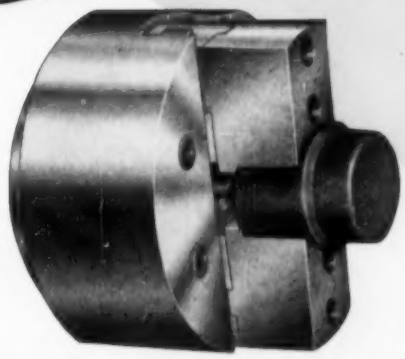

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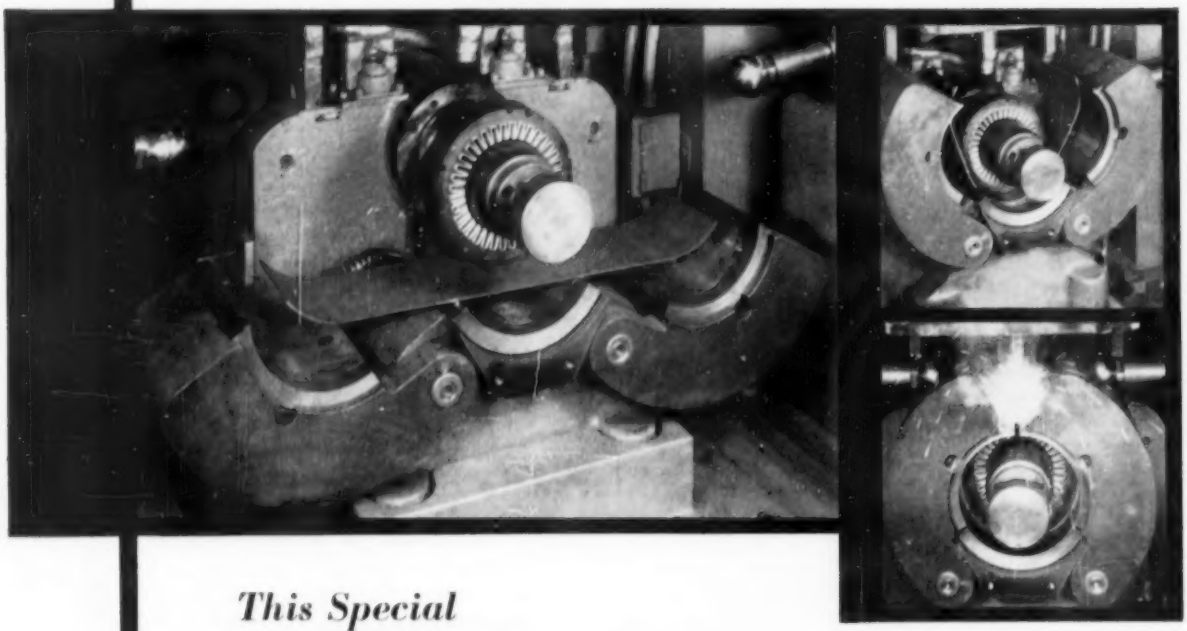

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Nuclear Controls for Industrial Processes

Tech Digests

By J. E. Reider

Industrial Nucleonics Corp.
Columbus, Ohio

IN ANY PRODUCTION CONTROL SYSTEM there are several functions which are performed regardless of the product. These can be described as measuring, controlling, monitoring, recording and classifying. Nuclear gages have been developed to a high level of accuracy, reliability and speed to meet these needs.

Production control systems using the noncontact type of measuring unit are in operation in metalworking, paper making, rubber and plastics, food processing, cigarette making and textile combing. Greater precision in the control of the process is obtained through the use of the radiation type measuring equipment, and related automatic controls, *Fig.* 1.

Noncontact thickness gages utilize some sort of radiation, commonly either X-ray or isotope emission. In measuring total strip thickness, a source of radiation is mounted underneath the strip, a detector above. The radiation which penetrates the strip is inversely proportional to the weight of the strip.

Production Control Requirements

In the design of equipment for automatically performing the functions of production control, there are certain requirements which must be satisfied. The measuring gage must have three basic characteristics: (1) accuracy, (2) dependability, and (3) high speed of response.

A complete control system should include data reduction equipment which, for example, may totalize the number of feet of strip within tolerance vs. that out-of-tolerance. Such equipment should read-out either on counter dials or directly on punch cards or tapes for further processing through accounting machinery. The X-ray coating thickness gage operates on a fluorescent principle that is, X-rays are beamed at the strip, penetrate through the coating, and excite the base metal which in turn reradiates X-ray waves of an entirely different length. This secondary radiation is used to measure the coating thickness.

Coating Gages

The beta ray thickness gage is almost a true reflection gage. The beta or isotope rays are beamed at the strip, penetrate the coating, and bounce from the base material back through the coating and are detected. As the coating weight increases, the number of beta rays which return to the detector either increase or decrease, depending upon the relative atomic weights of the base and coating materials.

Essentially the same beta reflection system can be used to measure the coating of zinc, tin, aluminum, enamels, or other material on any homogeneous base materials such as steel. *Fig.* 2 shows a typical isotope measuring head for installation on a hot dip galvanize line, or an electrolytic tinning line.

Measurement of electrolytic coatings on tinplate presents much the same problems as zinc coatings, with the added factor that the gage must be of high sensitivity because of the light weights of coatings applied.

Other Gages

Noncontacting, radiation gaging is in limited use throughout the metalworking industry for checking of pipe or tube wall thickness. In this particular application the measuring equipment is normally coupled with a classifying system in order to signal out-of-tolerance pipe or tube wall thickness and provide the operator with a visual signal in order that he may properly crop or shear off the out-of-tolerance ends of extruded pipe or tube.

Other applications of radiation measuring equipment are being developed for the metalworking industry. An example of two such applications are the measurement of fill in a closed crucible or in a blast furnace and the density measurement of various types of slurries.

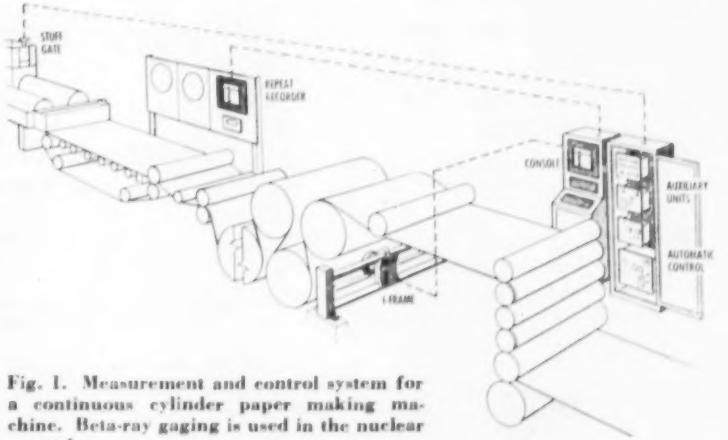

Fig. 1. Measurement and control system for a continuous cylinder paper making machine. Beta-ray gaging is used in the nuclear control.

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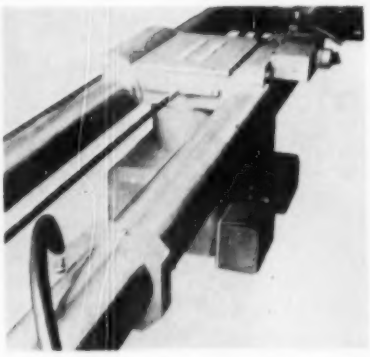

Fig. 2. Isotope measuring heads with summation computer controls thickness of galvanize on continuous line.

Controls for Plastics Processing

Noncontacting radiation measuring and control systems have become the accepted standard in the plastics industry where continuous process measurement and control of area weight has been long desired. Typical is the installation of noncontacting radiation gages on a polyethylene extrusion process.

Nuclear measuring systems are used in the paper industry to measure basic weight and to control the weight by adjusting automatically the stock flow through a stuff gate, or the machine speed.

In the manufacture of box board, the different grades of stock are used for the top and bottom liner vs. that used for the filler. Most of the basis weight is made up by the filler stock. Radiation gaging systems are used to control the flow of filler stock into the respective vats to control the overall basis weight.

Radiation measuring systems with computers are used to determine the weight of the coating or impregnant. The automatic controllers in the system are then actuated by the reading of the computer.

Automatic Control Foreseen

Data reduction and data readout systems are now available for providing accurate records for continuous processes having suitable transducers, *Fig.* 3. The data thus obtained form a major part of the quality and costing records for administrative control of such a process. In this case nuclear radiation gages along with other nondestructive testing equipment form the basis for a profit control system as well as being a single process control element.

The consequence of process control installations of the types described in bringing precision and accuracy to heretofore difficult process problems will no doubt reach into many other industries. The systems described in this paper are examples of what has been done to date. It is expected that techniques will improve rapidly making practical greater precision in the control of industrial processes.

From a paper given at the March 1957 Nuclear Congress, sponsored by The American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

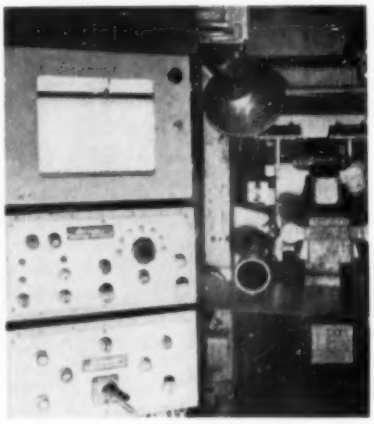

Fig. 3. Data reduction and readout system applied to electrolytic tinning line.

▼ ▼ ▼

Organizing for Design and Manufacture of Supersonic Aircraft

By Frank W. Davis
Chief Engineer
Convair
Div. of General Dynamics Corp.
Fort Worth, Texas

In military thinking a concept has taken hold which promises to basically alter present methods of procurement. This is the idea of the weapons system. An air weapon system is the total of air frame, engines, equipment, armament, and ground support necessary for an operational air weapon.

In the past engines and all subsystems such as communication, armament, navigation, bombing, electronic countermeasures, autopilot, tires and brakes,

have been procured separately by the government and furnished to the manufacturer for assembly in the final product. With the new concept, however, simplification of the management task associated with procurement of a weapon system is under way.

Matching all elements which make up the air weapon is a complex and laborious process. Each element affects some or all of the others. It has been found feasible to investigate and establish the effects of these many variables by application of computing machines. This type of technique makes possible an ideal combination and integration only dreamed of previously. Some of these factors which must be properly matched in time to achieve a satisfactory air weapon system are shown graphically in *Fig.* 1.

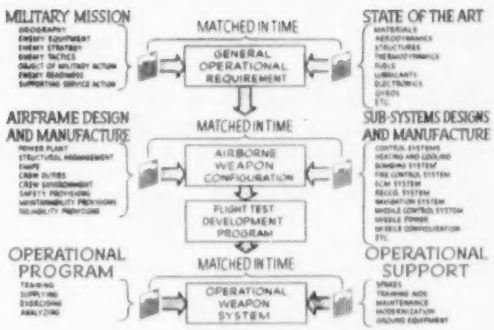

Fig. 1. Matching factors in Weapon System function.

To achieve the degree of integrated design necessary for efficient supersonic flight requires centralized design responsibilities. Technical integration can be achieved in an optimum degree only with centralized authority for the program, first within the Air Force or procuring agency and second by delegation to a single prime contractor, or weapon system manager. The B-58 program is the closest approach to this arrangement to be found to date.

The relationship is shown in *Fig.* 2, between the Air Force agencies, the Weapon System Project Office, the

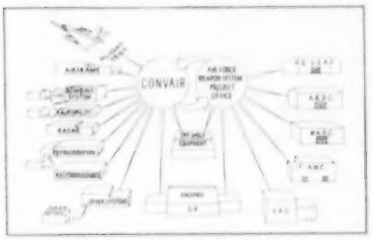

Fig. 2. The systems management partnership represented graphically.

prime contractor or weapon system manager, and the large number of subcontractors and vendors associated with the program. This system, relatively simple and direct, provides capability for rapid solution of problems and timely decisions.

It is often argued that each item of equipment developed for the Air Force should be applicable to more than one weapon system so that economy may be achieved in development and production. Perhaps this was true in the subsonic era where a voluminous airframe could accommodate an odd assortment of black boxes. If, however, the combination of engine, airframe and subsystems is to be efficient enough for a long range supersonic bomber, it is necessary that total integrated design of the weapon system be accomplished.

Design activities of a weapon system prime contractor take a new perspective. A design team must be developed capable of conceptual design, technical analysis, procurement negotiation, technical liaison, trouble-shooting, and operational evaluation. Such a group must have unusually broad scientific

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and engineered background. Typical skills for executing this type of program might require a distribution as follows in TABLE 1:

Supersonic aircraft also poses some real problems for the weapon system manufacturers. For instance, electromechanical design associated with the control system, dealing with servo loops, ratio changes, motion dampers, etc., introduces requirements for extremely high precision manufacture. The electronic and mechanical parts entail an unprecedented premium on reliability in uniformity. This work has been done by subsystem contractors rather than by the air frame contractor.

Other major problems growing out of the rise in air temperature with speed affect manufacturers of supersonic aircraft parts also. Temperatures of approximately 260 F must be dealt with. Sandwich construction, using aluminum skin bonded to fiberglass honeycomb core, has proved successful but has introduced new problems and techniques for the manufacturer. Process control rather than postinspection, has assumed increased importance.

Temperatures at supersonic speeds require a change from conventional aluminum structure to titanium or stainless steel for many parts. This introduces an extremely serious problem in production because machine cutting speeds are drastically reduced over those customary for aluminum. Effort must be applied to finding new methods of cutting these tough, hard materials. Re-equipment of facilities will be required to maintain volume of products.

Thus the technical problems in designing and producting this type of aircraft grow logically from the military requirements. Management problems grow logically from the manner in which technical problems must be solved. Manufacturing problems grow logically from materials of construction, size and character of the final product.

To summarize, it is obvious that the concept, design and manufacture of supersonic aircraft pose many new problems to the Air Force and defense industry.

Table 1—Distribution of Typical Air-Weapons Design Team

Personnel	Percent
Aeronautical Engineers	15 - 20
Mechanical Engineers	20 - 25
Civil or Structural Engineers	5 - 10
Electrical Engineers	20 - 25
Physicists	10 - 15
Mathematicians	5 - 10
Chemical and Metallurgical	5 - 10
Other	5 - 10
Ph.D.'s	3 - 5
M.S.'s	15 - 20
B.S.'s	70 - 80

From a paper, No. 49 given at the 1957 annual meeting in Detroit of the Society of Automotive Engineers, 485 Lexington Avenue, New York 17, N. Y.

▼ ▼ ▼

Costing Tools for Reinforced Plastic Parts

By Morgan Martin,
VP-Engrg.
Molded Fiber Glass Body Co.
Ashtabula, Ohio

Many parts which could be made of steel stampings can be more economically made of fiberglass because of the lower cost of tooling. Time required for completion of the tooling is often an important consideration, also.

Unless the part in question has been specifically designed to be made of fiberglass-reinforced plastic, changes in design may be necessary before the job can be figured. Thickness of the part especially should be carefully considered for maximum economy consistent with strength required. Actual composition of the part will depend on physical requirements, appearance standards, translucency, finish and whether or not part will be painted to match other parts of different materials. It is often necessary to figure special resins for use where part is to be finished with baked enamel.

Net weight of the molded part is cal-

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culated from the area, thickness, and composition. From the calculated weight, quantities of individual components are computed with respective prices and totaled to obtain cost of raw materials. It must be remembered that allowance for cutting waste, flash, and spillage must be made and that these will vary considerably depending on the size and shape of the part. Large, irregular parts to be made of mat may run as high as one-third waste in cutting the mat unless it is known for sure that mat for smaller parts can be cut out of that waste material.

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Unit prices of raw materials are generally adjusted to include cost of labor and overhead required for preparation of these materials ready for the molding operation. Cost of labor and overhead for preforming and molding operations is computed using estimated production rates for each operation with hourly rates appropriate to the equipment used.

Total of the labor and raw material costs is adjusted for anticipated scrap allowance in the molding operation to give a total cost of part ready to finish. Scrap rate will depend on anticipated molding difficulties, quality standards and amount of salvage which can be done without hurting the appearance. Cost of finishing operations is calculated in a similar manner and cost of any purchased items which go into the final assembly as shipped are added. Finally, cost of packaging material and labor is added to arrive at a total factory cost per part shipped. Addition of percentages for general and administrative overhead, selling expense, contingencies, and profit are included to arrive at a total price which could be quoted for continuous day in and day out production of the part. Since quantities are seldom required at the same rate that parts can be produced, cost of setup and efficiency factors must be added.

It should be possible to compute the cost of tooling by adding the individual costs of engineering and supervision, models, materials, labor, freight, tryout time and material, insurance, maintenance, and storage. Area of mold surface in square inches, lineal inches of pinch off, maximum over-all length and width of mold and depth of part as molded are multiplied by appropriate

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- ☐ Too many operations—cleaning, pickling, neutralizing, etc.—are needed to prepare steel that does not require phosphating before painting. See 4.

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constants and added together to obtain a total tool cost. This cost may be adjusted somewhat to cover variables. Customer may or may not furnish part models, keller models, checking fixtures, etc. These costs must be added or subtracted as the case may be.

As in the case of any job, tooling will be more or less elaborate depending on the anticipated volume. Low-cost drill baskets will do a good job on low-volume jobs, but piercing dies will more than pay for themselves on large runs, especially if there are many holes involved. Cost of improved tooling after a job is running can be amortized either by the molder or by the customer.

In some high-volume jobs it is necessary to figure several sets of molding dies in order to meet the anticipated requirements. Special preforming and material-handling equipment may be figured, but generally these items should be considered capital equipment to be purchased and owned by the molder instead of by the customer unless it is peculiar to the job being quoted and could not be altered for use with other similar jobs.

From a paper given at the 12th Annual Meeting, Chicago, Ill., of the Reinforced Plastics Division of The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.

▼ ▼ ▼

Progress Is Rapid in Impact Extrusion

By R. A. Quadt

Vice Pres.-Dir. of Research
Hunter Douglas Aluminum Corp.
Riverside, Calif.

In the aluminum field the strongest aluminum alloys, such as 7075 and 2014, are being cold extruded in lengths up to 60 ft, diameters up to 8 ft and with both internal and external discontinuous configurations as an integral part of tubular structures. Aluminum missile motor tubes for the Navy are in high quantity production. Considerable development work in this field is presently underway to further extend the process. Concentricity of ID to OD on these tubes are held to plus or minus 0.001 ft, straightness is within 0.003 ft per foot and other dimensions, well within the usual machining tolerance range, are readily held.

Considerable work is also being done on the low and medium carbon steels. Tubular shapes for missile applications are currently being produced on a development basis from 4130 steel and work

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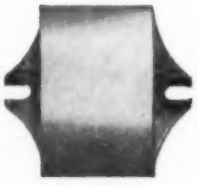

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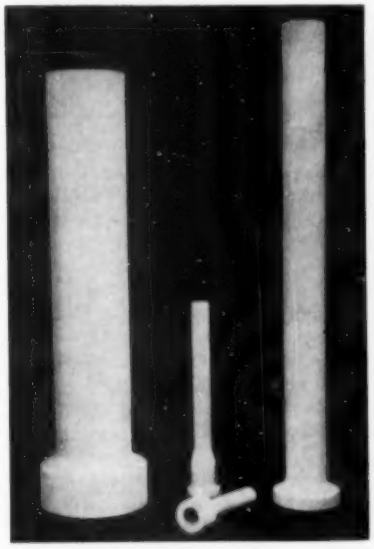
is being intiated on the stainless steels for relatively simple shapes requiring high dimensional accuracy to eliminate expensive machining operations.

Development work is underway for the AEC in the cold extrusion of zirconium, molybdenum, and other special reactor metals. Results to date have been most encouraging particularly with regard to reactor grade zirconium where finishes and tolerances in the same range as described for aluminum have been produced. The present state



Two large tubes with closed ends for pressure applications of 2014-T6 Al: Small ordinance part cold extruded of 6011-T6 alloy.

of the development work indicates a metal efficiency of 80 percent from starting slug to finished tubular shape as compared to present efficiencies in the 50 percent range obtained by normal hot extrusion and machining techniques.

In the commercial field, precision, no-draft, high strength cold extrusions are replacing machined iron castings at an economic advantage. The replacement is often an aluminum alloy cold extrusion replacing machined cast iron where the machining savings more than offset the higher cost of the starting resistance are bonus factors.

Efforts in cold extruding titanium and the new magnesium alloys also show promise and it seems reasonable to assume that as the requirement for these metals grows, refinement and improvements in the present state of the technology will be forthcoming.

From a paper given at the Western Metal Congress, March 1957, sponsored by The American Society for Metals, 7301 Euclid, Cleveland, Ohio.

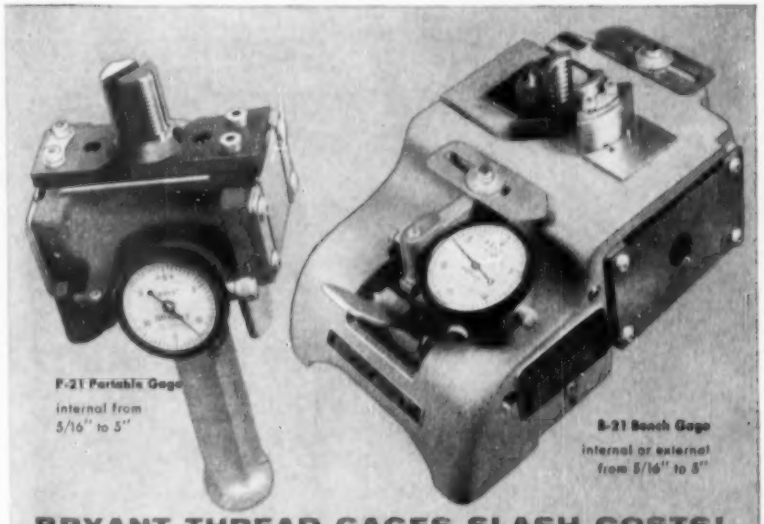
Reducing Maintenance in Metalworking Plants

By W. A. Irvine

Manager of Production Engineering
Maytag Co.
Newton, Iowa

Maintenance problems in the appliance industry are complicated by the diversity of manufacturing operations. Since Maytag makes a large proportion of component parts, its operations include as great a variety as any in the industry. With a total of about 3,000 employees in manufacturing, 275 are in maintenance of buildings, grounds, equipment and manufacturing facilities. Maintenance problems require an increasing degree of specialization with a large number of craftsmen required, including electricians, building mechanics, plumbers and pipefitters, millwrights, metalworkers, buildings and grounds men, carpenters and woodworkers, and steel boiler operators and compressor men. Continuity of production is of prime importance in mass production industries. This has been accelerated by the trend towards greater mechanization, grouping of machines in production lines and tying machine together with material handling equipment.

Guarding against interruptions in



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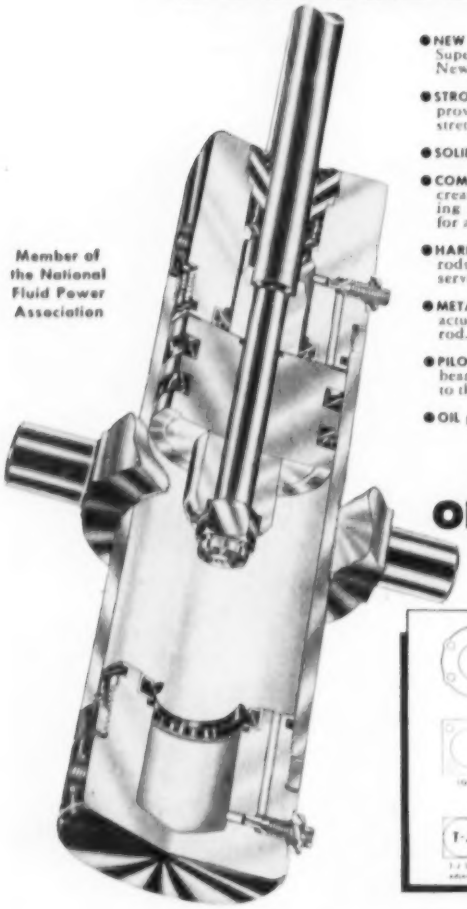

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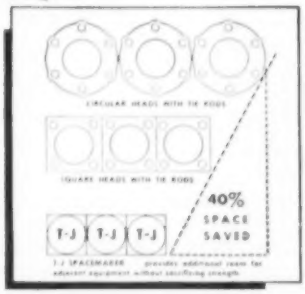

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production by excessive reserve equipment or large banks of in-process parts ties up much money and takes valuable floor space. Effective planned maintenance is the best assurance of continuity. Unless it is carefully planned and organized, however, it may result in high maintenance expense.

Organization for better maintenance has resulted in establishment of a planning group. One planner is assigned to each maintenance supervisor. The craft foreman and the planner agree on how each maintenance job should be done.

The planner then makes a detailed plan for the job. He decides how many craftsmen should be used and estimates hours required, materials and costs.

Work of the planners allows maintenance supervisors to concentrate on training and supervision of craftsmen and upon improvement of maintenance methods and equipment. The industrial engineering department checks each job and compares actual time with estimated. In this way, efficiency of the maintenance group is maintained. This combination of planning, scheduling and checking labor efficiencies has effected a marked improvement in maintenance costs.

From a paper given at the 8th Plant Maintenance and Engineering Show under sponsorship of Clapp & Poliak, Inc., New York, N. Y.

▼ ▼ ▼

Production Challenges of the Future

Lt. General C. S. Irvine
Deputy Chief of Staff, Materiel USAF

To keep the narrow lead this nation now has in airpower will take the dedicated, creative thinking of every scientist, engineer and production man in the country. In the future people must do, with tools and materials, what yesterday was impossible.

In the future, mass production is not as important as quality of the end item for aircraft and missiles. It is imperative that the lead time be reduced so that new items will give a real margin of superiority. Engineering and design output must be integrated early in the development period. Aerodynamic and materials engineers, tool designers and electronic specialists must maintain close and constant liaison with each other so that system compatibility and performance are assured.

One step toward improving use of engineering efforts is the scientific application of electronic computers. Great strides are being made in applying this electronic slide rules in vast new areas of usage.

It is difficult for engineering staffs to stay abreast of what is taking place in all laboratories and drafting rooms across the nation. Exchange of information as conducted by the Aircraft Industries Association and Armed Services Technical Information Agency increase the dissemination of new information.

Any attempt to hold fundamental engineering information within a company's walls is a detriment to progress.

New Materials Needed

Foremost among engineering problems in future air vehicles are those of developing and using new materials capable of withstanding sonic vibration and high temperatures. New alloys such as columbium base alloy may be expected in structural parts of nuclear air vehicles. Also to be anticipated are developments of cermets with sufficient toughness for use in the next family of high performance turbo and ram jet engines.

Titanium must be developed for the 1200 F range; ductile chromium-base alloys and research in use of berrylium are other obvious requirements. Engineers must cooperate fully with laboratory researchers seeking to acquire necessary data. Unless advancement is made in the state of the art of thermal resistant materials, air vehicle development will lag.

It is recognized that cutting and forming these materials is in itself an extremely difficult field of endeavor. But the gauntlet must be picked up and new metalworking approaches developed.

To meet these challenges, numerous efforts are being made by industry to improve current tooling methods. For example, much research is being conducted with the use of explosives and other high energy rate devices to form extremely hard metals and materials. In addition, such methods as low temperature shock fracture, electro erosive, high speed friction, band sawing and ultrasonics are being investigated as a means of high speed billet cutting. These show promise of solving the cutting problem. They also indicate a possible reduction of material wastage which occurs in normal cutting.

The producibility of any given air vehicle is dictated by the materials used and by the tooling methods applied to those materials. Regardless of how good it is in design, it cannot be translated into an end item until these problems have been solved. In the industrial family, engineers are best qualified to accelerate these solutions.

This hypersonic age is posing challenges to production far greater than any ever before experienced. The outer most limits of knowledge are rapidly being reached regarding propulsion systems, aerodynamics, materials and electronics.

The seriousness of the problem is one of national survival. This country's present leadership in development and production of air vehicles can be directly attributed to the output of dedicated engineers. But this nation cannot rest on past performance. Every engineering department in the country must exert every ounce of creative energy to penetrate the barriers to scientific and engineering knowledge.

At the same time management must provide greater public recognition of the role of engineers in preserving this way of life. More incentives and monetary rewards must be provided to compensate for the significant contributions being made. Management people, professional engineers and plain citizens, must put forth every possible effort to attract young people into these critical fields. The ability to project national well being into the future depends upon the continued good health of the engineering force.

From a talk given at the SAE National Aeronautic Forum, April 1957, Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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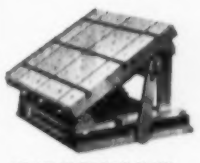

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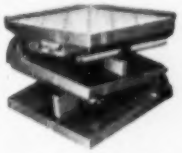

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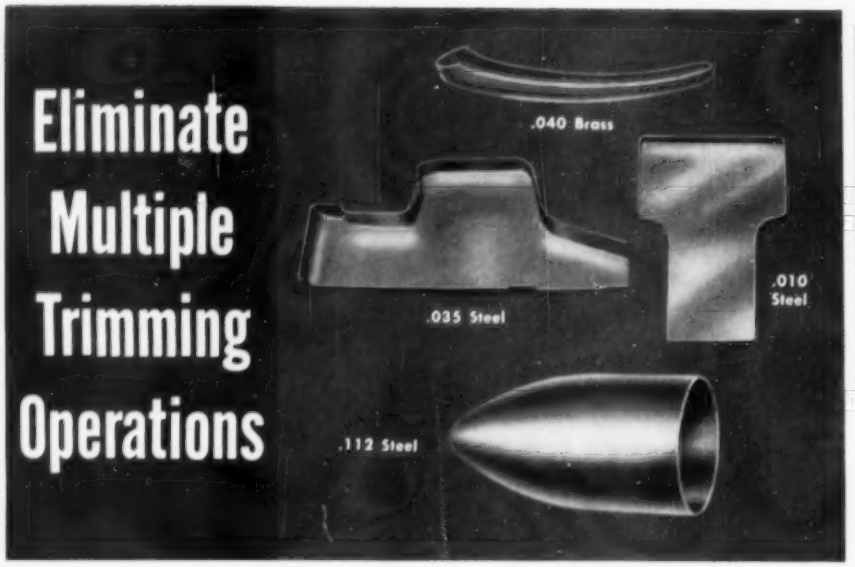

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Value Added By Engineering

By Joseph H. Gepfert
Division Manager
Reeves Pulley Co.
Cleveland, Ohio

When the Department of Commerce talks about the gross national product, they include something called value added by manufacturer. Another category is being considered, called value added by distribution. A new concept should be established: value added by engineering. Industry is supported by ideas. All companies start with engineering. Engineering is an attitude and does not mean that someone is a graduate of a well known technical school. Engineers are made by their attitudes, just as industry is supported by ideas.

An engineer is essentially a problem solver. For example, Mr. Tinnerman in Cleveland used to make stoves. Then he became concerned with the problem of holding sheet metal together under varying conditions of temperature. So he came up with a spring-loaded nut.

Soon he was out of the stove business and making this new type of nut. Starting in a small building the business has expanded to a plant employing 700 to 800 people making 10 or 12 million fasteners a day.

This is an example of an idea that was turned into a business supporting a thousand people. Now the gross national product includes those of the Tinnerman Company, but where is there anything to reflect the contribution of engineering?

Once an old designer had over his desk a sign that read, "When in trouble, as a last resort come to the engineering department." That's usually what happens. It should be turned around. The proper concept is: "There is no better place to go than the engineering department."

Engineers live on ideas. Ideas have brought into being hundreds of companies. They have been created because someone thought that they could do something differently and a little better. To that engineers add the use of the equipment; the place that it can fill.

Engineers are the practical people who take a slotter designed for use on brass and adapt it for use on steel. Theirs is the understanding of differences that exist in production systems-between natural rubber and plastics groups-for instance. It is the engineers who make things go.

The lot of engineers would be greatly improved if this fact was made more

generally known; if people understood how the value they add to a product comes about.

As an example, why is there an atomic industry. A scientist came up with an idea. It took 30 to 40 years to get general acceptance of it. Then an engineer came along and did something with it. He found a practical use for the scientist's theories. So a new industry is created because an engineer did something.

So to raise its level, the profession should start talking about this "value added" by engineering and the fact that companies cannot stay in business without ideas. A new type of government statistic is needed which will make people conscious of this and will recognize engineering as the force that keeps the economy moving.

From a talk given at the 14th Annual Machine Design Conference, Cleveland Engineering Society, Cleveland, Ohio, March, 1957.

▼ ▼ ▼

Prospects for 1957 Graduates

Dr. Harlan Hatcher
President
University of Michigan
Ann Arbor, Mich.

This year in the recruitment of employees from colleges, industry will find that there are more jobs, more graduates, more money and more shortages. There are so many jobs that the existence of more graduates this year will not close the gap or even appreciably lessen it. The number of companies sending representatives to the U. of M. to interview prospective graduates is running ten percent ahead of last year for liberal arts and nearly forty percent for engineering. Starting salaries will be higher than last year's averages of $360 for bachelor degrees and liberal arts; $426 in engineering, mathematics, physics and chemistry; and $398 for business administration.

Today's graduates are keenly interested in personal opportunity and challenge. They have grown up in an expanding economy and they have no doubt that it will continue to expand. Their emphasis, therefore, is less on the company's position in the market than upon what the company can offer them in terms of a chance to use what they consider to be their ability and training. They expect to enter with the real business of working. Sixty percent of college graduates change jobs during their first five years, most frequent-

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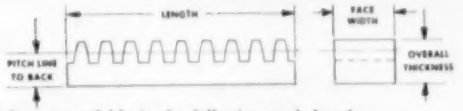

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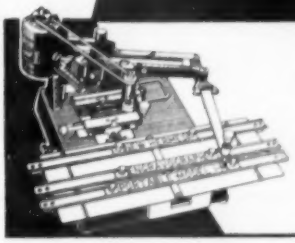

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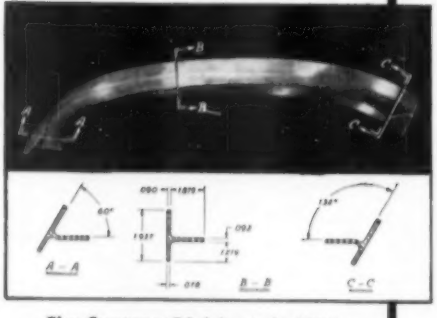
Bath methods yield accurate parts in the toughest metals... jet engine rings, aircraft and missile shapes, and parts for many other industries.



The Contract Division's facilities are available for production of parts in lots of 100 to 100,000. Send your inquiries to our Estimating Department or write for literature describing in detail the Bath forming methods and the contract facilities available.

THE CYRIL BATH COMPANY

32382 **AURORA ROAD • SOLON, OHIO**
(LOCATED IN THE GREATER CLEVELAND AREA)
Manufacturers of Radial Draw Formers • Dies • Tools
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ly because the company puts them to doing "clerk's work" or does not assign them enough work. Because the graduate realizes that he is in a worker's market, he can demand a job that will give him personal desires and goals.

Goals Are Changed

This doesn't mean that he is looking for a soft job. Most graduates today are success-centered to a high degree, but their concept of success is not the traditional one. Few dream of being presidents or even vice presidents. They are willing to settle for the middle run of executive positions because they feel the price of the ultimate in business success is too high.

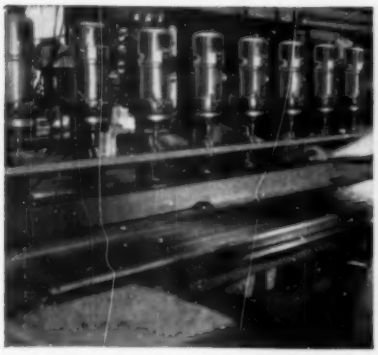
With the price going up business will want to make sure doubly that it gets its money's worth from those it employs. One way is to use graduates with specialized training only for work for which their training uniquely prepares them, for example, more use of technicians. Technicians are in short supply, too, but the deficiency could be made up more easily and rapidly at that level. Industry should offer some of this training and should help the educational institutions to offer it.

Colleges and universities are watching somewhat helplessly as business and industry cast covetous eyes upon the recipients of master's and doctor's degrees. Education and industry are in competition for the most highly trained of our graduates. If industry takes too many of these people, the colleges will be sadly handicapped in their efforts to continue to prepare other young people for their places in business and industry and science tomorrow.

More use of liberal arts graduates, a source of trained minds that has neither been fully used nor explored by the business world, and a more realistic and efficient and perhaps less expensive recruitment program are worth considering. Companies that send "career experts" to interview college seniors, experts who can really counsel the students, can present their specific job offers more effectively.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

From a panel on work force trends at the Midwinter Personnel Conference at Chicago, Ill., February 1957, sponsored by American Management Association, 1515 Broadway, New York 36, N. Y.



NEW Drill Set-Up Cuts 5-Day's Production to 5 Hours

Part of the production operation for the Western Patio Door Co., Berkley, California, is the drilling of eight holes in extruded aluminum sides for glass patio doors. By drilling one hole at a time and indexing the part eight times, 1200 pieces were produced in five eight-hour days. In an attempt to speed up this operation, and thereby cut costs, the set-up as shown was suggested.

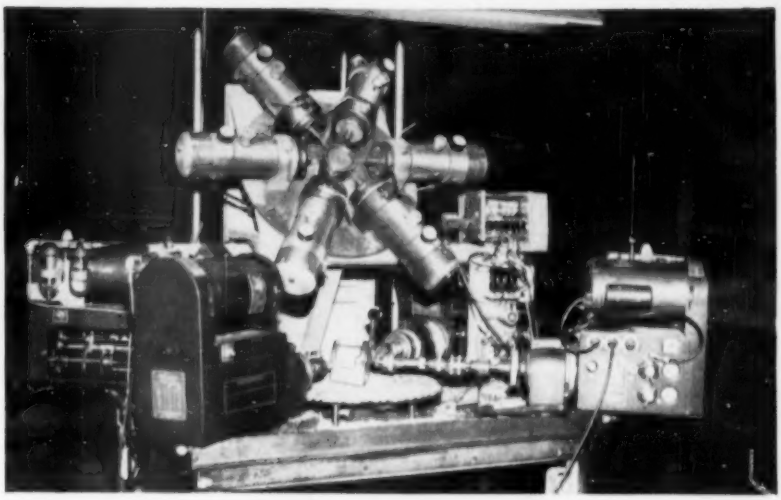
Set-Up

Now, the parts are fed to the operator on a slanted track-way under the new drilling machine. Pieces are then hand loaded and clamped into position. The operator actuates the machine by pressing one starter button. Eight heads with #38 drills then produce eight 3/16" blind holes in the part simultaneously in a matter of seconds.

This manufacturer now gets four of these parts drilled per minute. This includes loading, drilling, unloading and stacking finished parts. 1200 sides are completed in five hours, whereas it formerly required five eight-hour days. The time savings resulted in a substantial reduction in the production costs on this operation.

Drill Head Type

The drill head used for this unique machine is the Dumore Series 20 Automatic Drill Head. It utilizes the "resistance drilling" technique which permits the workpiece to determine the rate of drill feed and speed. Built-in controls practically eliminate drill breakage and scrap losses. It automatically maintains the correct feed pressure, pre-selected drilling depth accurate to .004" and the right drill speed for type of work. This compact, easy to mount tool is ideal for high production drilling of small parts. No. 80 to 5/32" drill capacity. For further information on this and other Dumore precision tools, write to The Dumore Company, 1310 Seventeenth Street, Racine, Wisconsin.



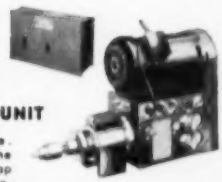
Standard DUMORE Components Make Special Production Machines . . .

for Quick, Low-Cost AUTOMATION

Presto Line Corp., Los Angeles, uses three types of Dumore standard components. These inexpensive precision tools are easily arranged in the set-up as shown. On it, zinc die castings are recessed, tapped and drilled in one continuous operation handled by one man. From 260 to 300 pieces per hour flow through this set-up with *no scrap losses.*

Two Dumore Series 24 Units are mounted on the work table with simple standard nose brackets, one on the right corner and the other opposite. These recess both ends of castings simultaneously. On the other two corners are two Dumore Series 28 Units which tap both ends simultaneously, after castings index automatically from recessing position. The operator then places the workpieces on the fixture above, consisting of six Dumore Series 20 Units which drill six 3/32" holes at once.

By using Dumore standard components, this manufacturer gained quick, precision automation at low initial machine cost.



NEW Series 28 AUTOMATIC "DRILL-N-TAP" UNIT

Two tools in one. Drills or taps at the flip of a switch. Tap fits into chuck, no extra head required. For long or short runs. Reversing motor removes tap, eliminates expensive clutches. Spindle speeds 265 to 4900 rpm. Mounts anywhere with simple nose bracket attachment.

Series 24 AUTOMATIC DRILL UNIT

All controls built-in. For production runs with varying conditions and frequent changeovers — single or multi-unit operations. Variable speeds, feeds, depths. Nose mounting bracket, Hydraulic Feed Control and chip breaking accessories available.

Series 20 AUTOMATIC DRILL HEAD

Economical, dependable unit for small parts drilling. Built-in controls. No. 80 to 5/32" drill capacity.

Get the facts on how Dumore automatic standard components can give you low cost precision automation for your work. Ask your distributor for details, or write . . .

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CHECK THESE "ADVANCE-DESIGN" ADVANTAGES!

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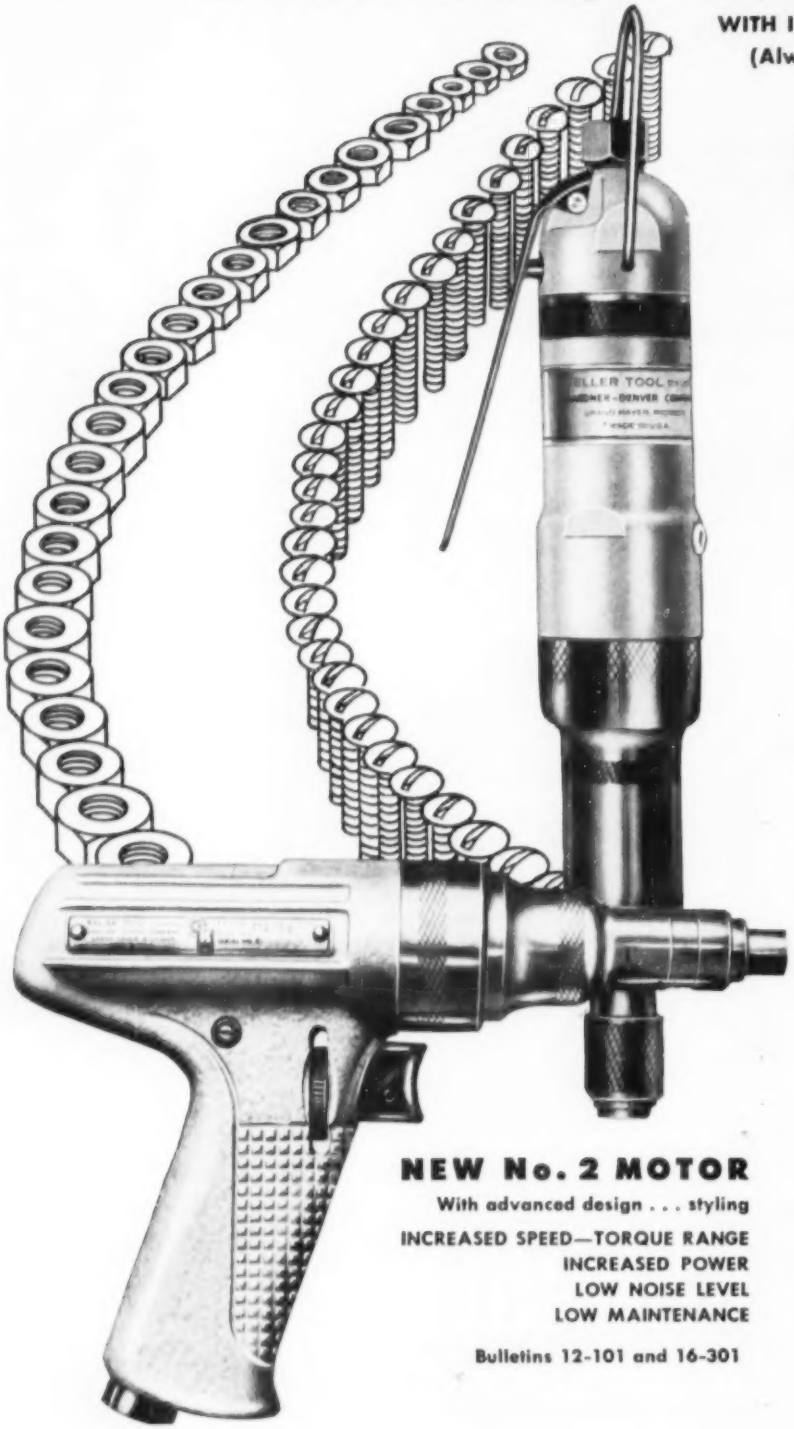
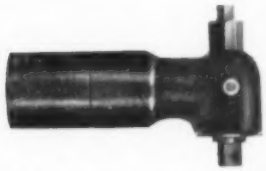
WITH INTERCHANGEABLE ATTACHMENTS
(Always a feature of Keller Tools)



IN-LINE—HIGH PRODUCTION

Drives: Straight, positive, cushion or "Safe-Torque".
Finders: Standard, collet, magnetic.
Holders: Snap-in, magnetic.



HEAVY DUTY—HIGH PRODUCTION
Single-end, double-end, long, short models.
In-line or detachable drives listed above.

LIGHT DUTY — CONFINED SPACES
90°, 45°, single end, double end.
Direct drive only.

***RATCHET WRENCH—IMPOSSIBLE JOBS** Variety of sockets, lengths, thicknesses.
Open end, 20° angle, unusual adaptations.

***DRILL—HIGH PRODUCTION**
Straight or angle type.

NEW No. 2 MOTOR
With advanced design . . . styling
INCREASED SPEED—TORQUE RANGE
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LOW MAINTENANCE

Bulletins 12-101 and 16-301

*Requires different gear case.

PRECISE TORQUE CONTROL

The new "SAFE TORQUE"* clutch assures accurate torque control for the new, more powerful in-line screw drivers and nut setters featured on the opposite page.

CONTROLLED TORQUE from 10 to 108 inch-pounds. Easily preset to predetermined torque. Retains accuracy on long production runs.

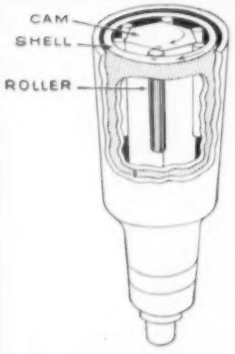
ACCURATE TORQUE setting on any fastening job—compressible, non-compressible, paper-thin or stacked materials.

SIGNALS OPERATOR with audible click when clutch automatically disengages at preset torque. No over-ride impacting. Tamper-proof.

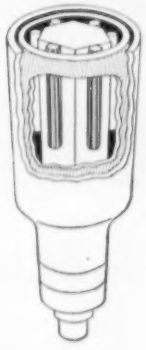
NEW MECHANISM INTERCHANGEABLE with cushion clutch mechanism in present 000, 00 and R size Keller tools.

*Licensed Trade-Mark of Scully-Jones and Company.

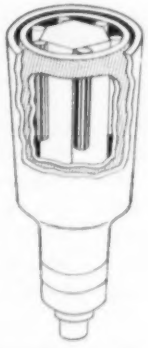
"SAFE-TORQUE" SPEEDS ACCURATE PRODUCTION



DRIVE—Equally spaced rollers are positioned between raised cam surfaces and the inside of a shell. Slight pressure on the bit causes rollers to climb into wedging position. The rotating clutch outer shell then transmits drive through rollers to cam and bit. Upon reaching a torque resistance which elastically deforms the driving shell, the rollers ride over high spots on the cam.

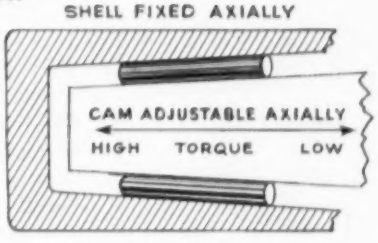


FREE WHEELING—The clutch is now in free wheeling and will so remain when the tool is lifted. No power is transmitted to the bit.



READY TO DRIVE—Instantly, upon applying bit pressure to the next fastening, the clutch again engages to repeat driving action. No lost driving motion . . . no sliding surfaces to create frictional wear.

TORQUE ADJUSTMENT—No tools needed for torque adjustment. Calibrations on the adjusting collar permit preset torque from 10 to 108 inch-pounds. Tamper-proof by operator. Bulletin 12-81.



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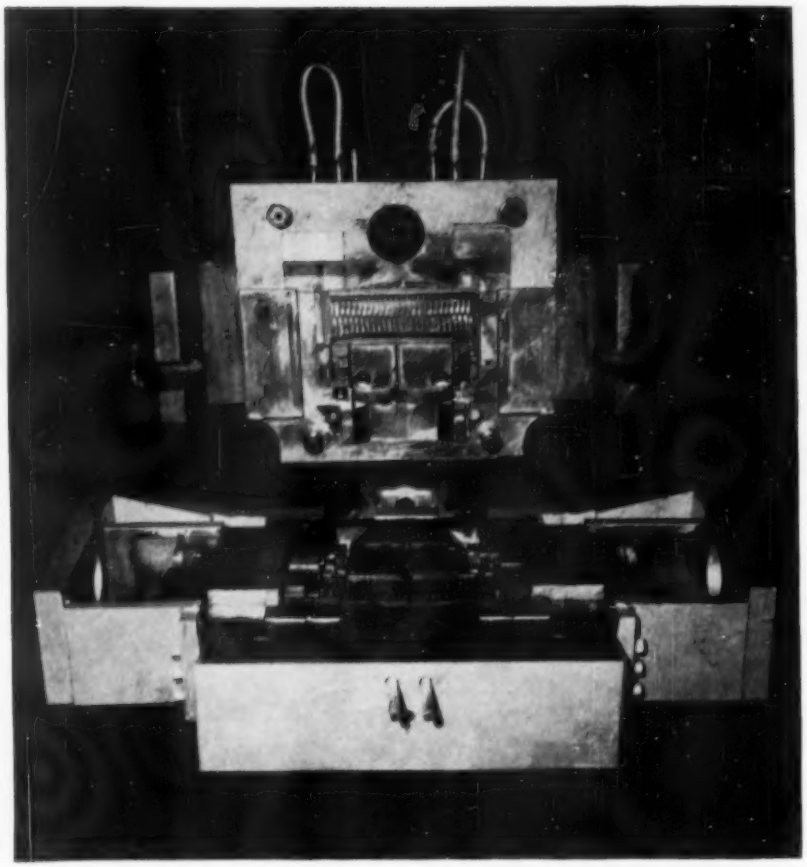

No matter what your DIE-CASTING JOB may be...

Accuracy calls for POTOMAC M Hot Work Die Steel

Write for BLUE SHEET on POTOMAC M

This concise four-page folder gives all needed handling and shop treatment details on Potomac M. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. TE-90

In the precision casting of aluminum, POTOMAC M Hot-Work Die Steel is especially favored as the material for die-casting dies because its properties help assure accuracy of the steel itself *after* heat treatment. Die makers have found that size changes are held to a minimum. Dimensional stability is thus the *first* contribution that POTOMAC M makes to accuracy.

Production accuracy of the die after it is in service is maintained also by the resistance of POTOMAC M to wear, to heat checking, and to metal wash.

Allegheny Ludlum makes a complete line of steels for hot-work tooling of various kinds—so, whether your need is the mass producing of duplicate parts or fabricating a few of them, call up or write "A-L" every time for hot-work counsel or service or both. Just tell us your requirements.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

Allegheny Ludlum

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81-Block
REFERENCE SET

VK "Quality in Millionths"

VAN KEUREN
RECTANGULAR GAGE BLOCKS

Thirty-eight years of experience in manufacturing gage blocks plus the finest in modern measuring instrumentation produce the *"Quality in Millionths"* evident in VK rectangular gage blocks.

These gages are the end product of many skills developed over a long period of time. Final accuracy is controlled by absolute measurement of our master standards on the latest design Zeiss Interferometer, and by comparison with masters calibrated by Interferometry at the National Bureau of Standards, Washington, D.C. VK gage block measurements are made in a modern Gage Room in which temperature is held to 68° ± .1°F. Surface finish is inspected by a Zeiss Interference Microscope.

Van Keuren rectangular gage blocks are offered in Class A (± .000004") and Class B (± .000008") accuracy. They are guaranteed for length, flatness, parallelism, surface finish, hardness and stability. A certificate showing the exact size of each block is furnished with all Class A sets.

VK MICROGAGES

Set M35L Price $120.00

For "working" gage blocks we recommend VK ⅞" diameter microgages in the new Class "A" (+.000008"—.000000") accuracy. These gages are available in 16 sets, including the 35 block set shown above, and the valuable set M81 at $250.00.

The tolerance on VK microgages has again been halved, and all microgages are now furnished to +.000008" —.000000", at no increase in price. Tolerance is all plus to provide necessary wear allowance on working blocks.

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Types to fit any machine used for tapping or reaming.

Making set-ups for tapping and reaming can be done with Ziegler Tool Holders at a lower labor cost than with ordinary tool holders for the simple reason that it takes less time with a Ziegler.

Just align the work to within 1/32" of accuracy on the radius (1/16" on the diameter) and the job is done—because the Ziegler Holder automatically compensates for the inaccuracy.

If you have never used a Ziegler, a big surprise awaits you the first time you give it a trial.

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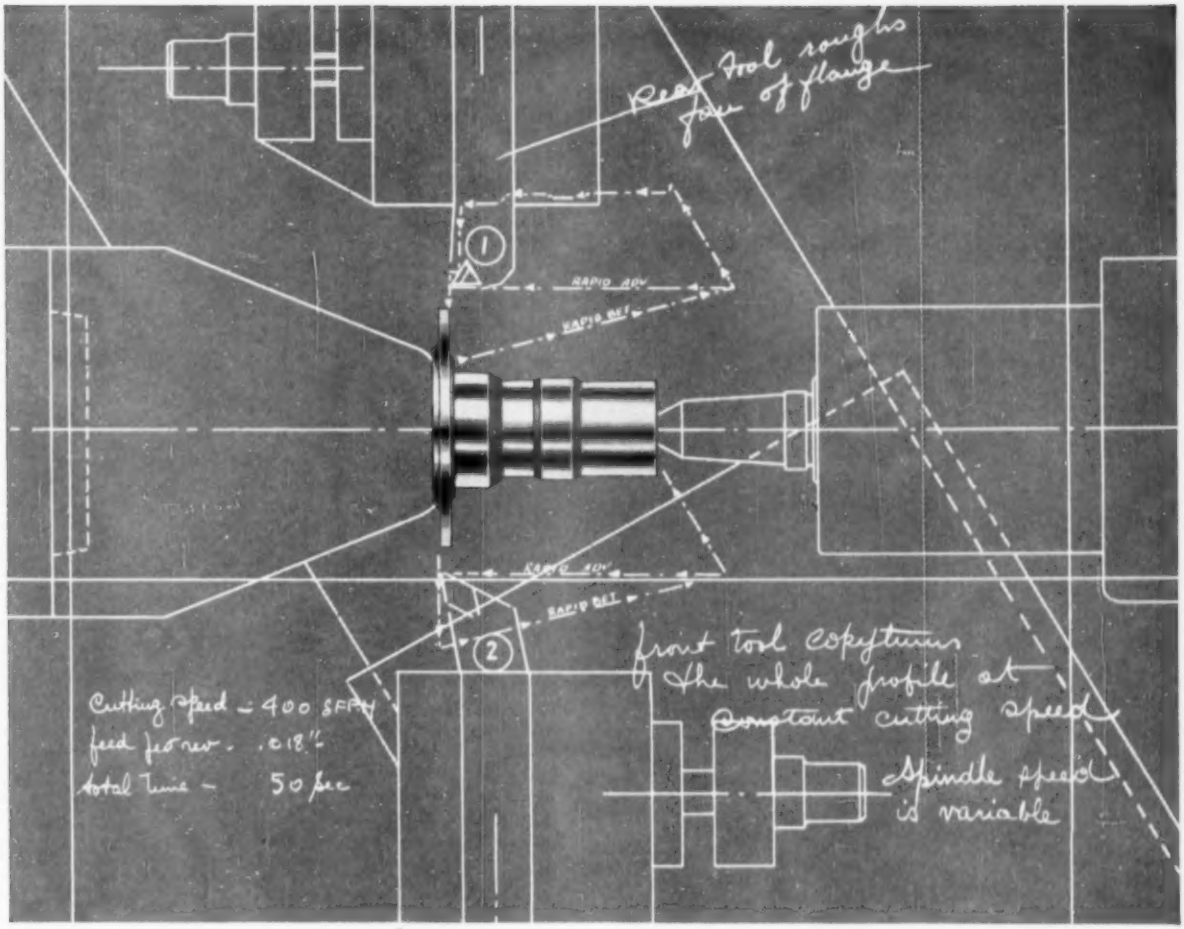
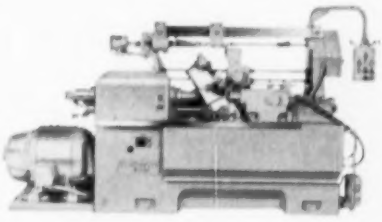

Rear tool roughs face of flange
RAPID ADV
RAPID RET
RAPID ADV
RAPID RET
Cutting Speed = 400 SFPM
feed per rev. .018"
total Time = 50 sec
front tool copyturns the whole profile at constant cutting speed
Spindle speed is variable

In 50 seconds

the Conomatic Pilot copyturns this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

Write today for details of the Conomatic Pilot lathe.



The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

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Made circumferentially corrugated without molds or other tooling, in inside diameters ranging from ¼" to 48", and engineered to your particular requirements, these products may furnish the answer to difficult-to-solve application problems.

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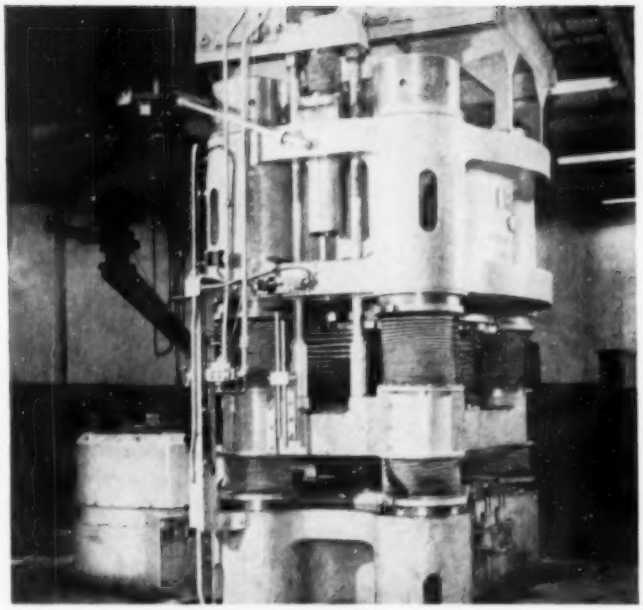
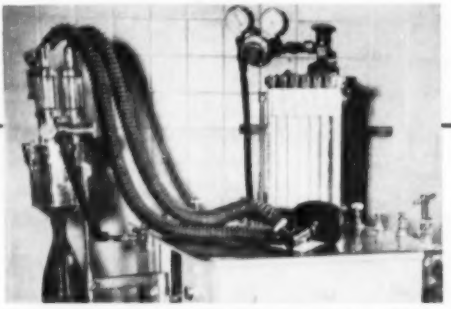
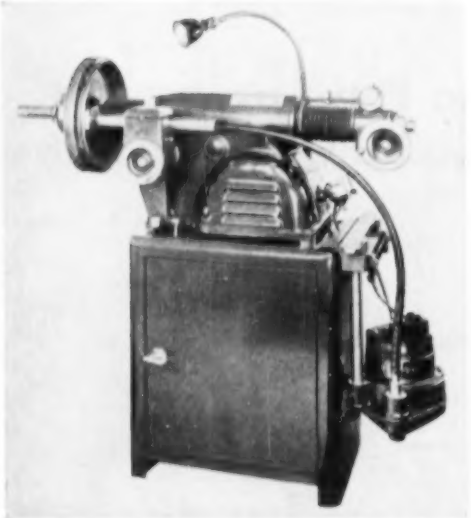


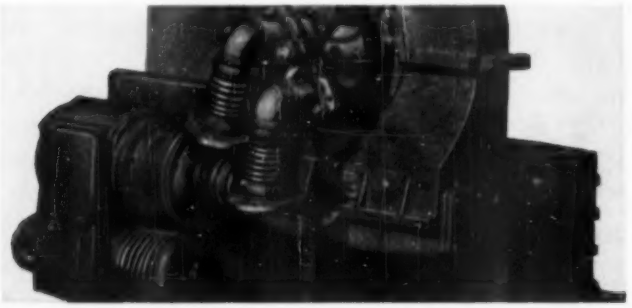
Multi-Flex laced boots keep dirt and grit out of hydraulic rams. They are laced for easy installation without dismantling press.



Multi-Flex conductive tube—extra-flexible and lightweight—in use on anesthesia equipment.



Multi-Flex boots giving constant protection to the shaft on this brake drum lathe.



Multi-Flex connectors on vacuum filter, taking care of axial movement and misalignment.

Mechanical Goods Division

United States Rubber

OVER

Warranty: 16 oz. of First Quality in every pound!

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Produced by Vanadium-Alloys Steel Company to *first quality* metallurgical and performance standards, these die steels match every hot work need in the metal-forming industries. They are the specialized products of tool steel specialists, made in a plant devoted exclusively to fine tool steels. Let our district sales engineers aid you in selection and application—their trained services are yours without obligation of any kind.

Hotform — The most widely used of all hot work die steels. 5% chromium—tops in strength and toughness, plus resistance to heat checking. Use for die casting, extrusion and hot forging dies, backer blocks, mandrels, etc.

Hotpress — Tungsten Die Steel with additional toughness for high temperature work. Outstanding on dummy blocks for brass extrusion, upsetting dies, extrusion dies, and press dies.

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Marvel — 10% Tungsten Hot Work Die Steel for tools requiring better resistance to high temperatures. Excellent for punches, nut piercers and dies, and brass forging dies.

Red Cut Superior J Temper — Tungsten High Speed Die Steel for high temperature service, having excellent hot hardness properties and wear resistance. Outstanding on extrusion dies, hot press dies, trimming dies, and puoches.

Forge-Die — 14% Tungsten Hot Work Steel, having high resistance to softening at elevated temperatures. Recommended for piercers, punches, and hot forming dies.

WW Hotwork — High Alloy Steel developed for maximum wear resistance at elevated temperatures. Used for copper and brass extruding dies, brass die casting dies, piercers for copper tubing, and nozzles on zinc die casting machines.

WCC — New, very deep hardening tungsten, chromium, cobalt and vanadium steel—outperforming 9.50 tungsten types. High resistance to wear and thermal fatigue. Use for hot extrusion dies, permanent molds for brass casting, forging die inserts, hot-press dies.

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

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Onsrud® innovation and

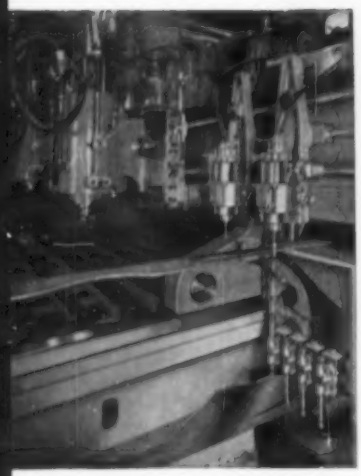
SPECIALLY DESIGNED FOR HIGH-SPEED ALUMINUM MILLING

● Everything Onsrud designs and builds . . . from machine tool components supplied to equipment builders to complete milling machines . . . everything from a 20 ounce high speed spindle to a 100 ton electronically controlled contour mill . . . is made for the specific purpose of milling ALUMINUM and related nonferrous metals. As you plan for new production or review your present methods and machines, if your objective is to find the means of *reducing costs*, be sure to let an Onsrud representative show you the ways Onsrud specialization can help you.

PROVED BY EXPERIENCE

● Onsrud has been a designer and supplier of production milling machines for the aircraft industry for over twenty years. Since 1945 Onsrud has developed a series of special high speed machines now in use in a variety of industries . . . all for the mass production milling of aluminum and other nonferrous metal parts.

Onsrud today has successfully developed and built special electronically controlled milling machines for hyper-speed face, profile and contour milling involving three dimensional and three directional infinitely variable milling feeds.



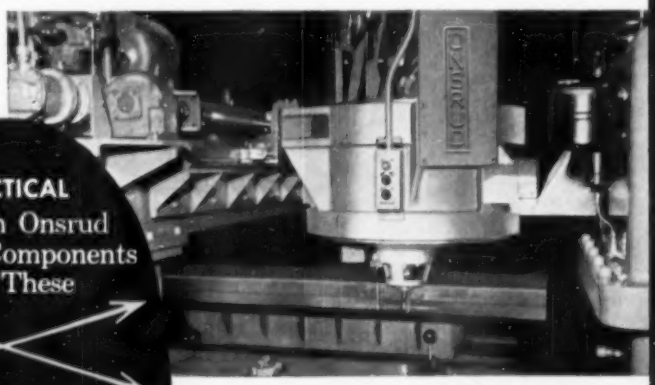
ELECTRONIC CONTROL SYSTEMS For control of speeds and feeds beyond the limits of mechanical systems and manual control . . . and extension of production milling machine application to parts impossible to machine before. Designed and built as Selsyn follower, analog and digital systems.

HIGH SPEED INDUCTION MOTORS

Built in capacities from 1 to 150 HP, for spindle speeds from 3,600 to 20,000 RPM. Air or liquid cooled for greatest possible sustained and intermittent overloads.

PRACTICAL
Through Onsrud Machine Components Like These

A wide variety of components are offered to manufacturers wishing to build their own special machines . . . components that are also employed in Onsrud designed and built milling machines. Typical components include:



INVOMIL® ROTARY MILLING HEAD

One of the most unusual milling head assemblies in the machine tool field. Provides infinite rotary feed of milling head through 360°. When mounted on gantry type carriage, in combination with conventional transverse and longitudinal feeds, provides infinite feed of milling head through any point on table.

HYPER-SPEED SPINDLES

Specially designed and built for the high rotational speeds of Onsrud motors. Assemblies equipped with preloaded bearings for precision end milling application. Dynamically balanced for vibration-free operation.

FAMOUS ONSRUD FIRSTS

- air turbine drives
- Metered Mist lubrication systems for high speed spindles
- water and air cooled high cycle induction drive motors
- InvOmil rotary feed milling head
- rotary table feed for automatic milling

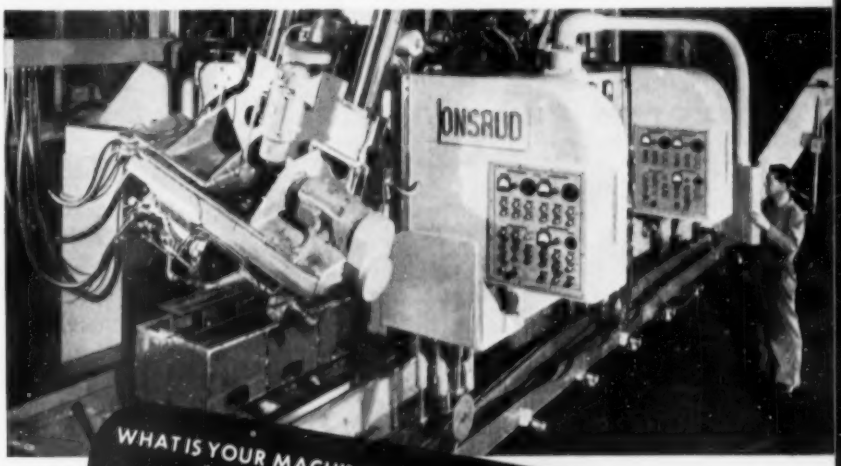
Onsrud® FOR

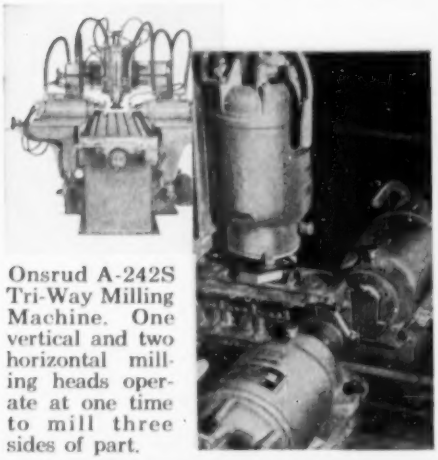
leadership to serve you...

When the parts to be milled are
ALUMINUM
Alloys or related nonferrous metals

TYPICAL ONSRUD MACHINES NOW USED IN PRODUCTION MILLING

Onsrud A90-36 Automatic Contour or Profile Milling Machine with electronic and electro-hydraulic tracer Selsyn control system. For milling aircraft spar beams and other structural members. Reduces machine time and expands application. A precision machine for high speed automatic production.



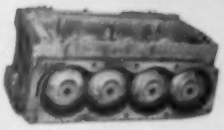


Onsrud A-242S Tri-Way Milling Machine. One vertical and two horizontal milling heads operate at one time to mill three sides of part.

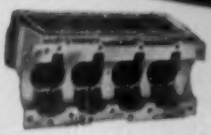
Onsrud AA50-AE Rotary Feed Milling Machine, equipped with vertical head mounted on pivoted overarm. Follower on head assembly follows template as milling cutter reproduces template contour or line on work piece.

WHAT IS YOUR MACHINING TIME NOW ON PARTS LIKE THESE?

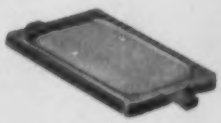
These parts are a few examples of the production time savings possible with Onsrud equipment.



Outboard Motor Housing, aluminum alloy casting, 7" wide x 13" long and 6" high. Machine three faces in one setup. Production . . . three complete parts per minute.



Double Section Skillet, aluminum alloy casting, 10½" square x 3" high. Three different setups to complete parts. Production per setup . . . three parts per minute.



Flat Griddle, aluminum alloy casting; 11" x 11½" x 9/16" high. Machine four sides and face of top rim in one setup. Production . . . two parts per minute.

Aluminum alloy carburetor part. Face mill two sides . . . production four parts per minute.

Steam iron sole plate, aluminum alloy. Face milling operation . . . six parts per minute.

Onsrud offers components, standard machines, and machines built to your production specifications . . . all for the super high speed production milling of aluminum and related metals. May we invite your inquiry for complete information?

ONSRUD
MACHINE WORKS, INC.
MACHINE TOOL DIVISION
7704 Lehigh Avenue
Niles 31, Illinois

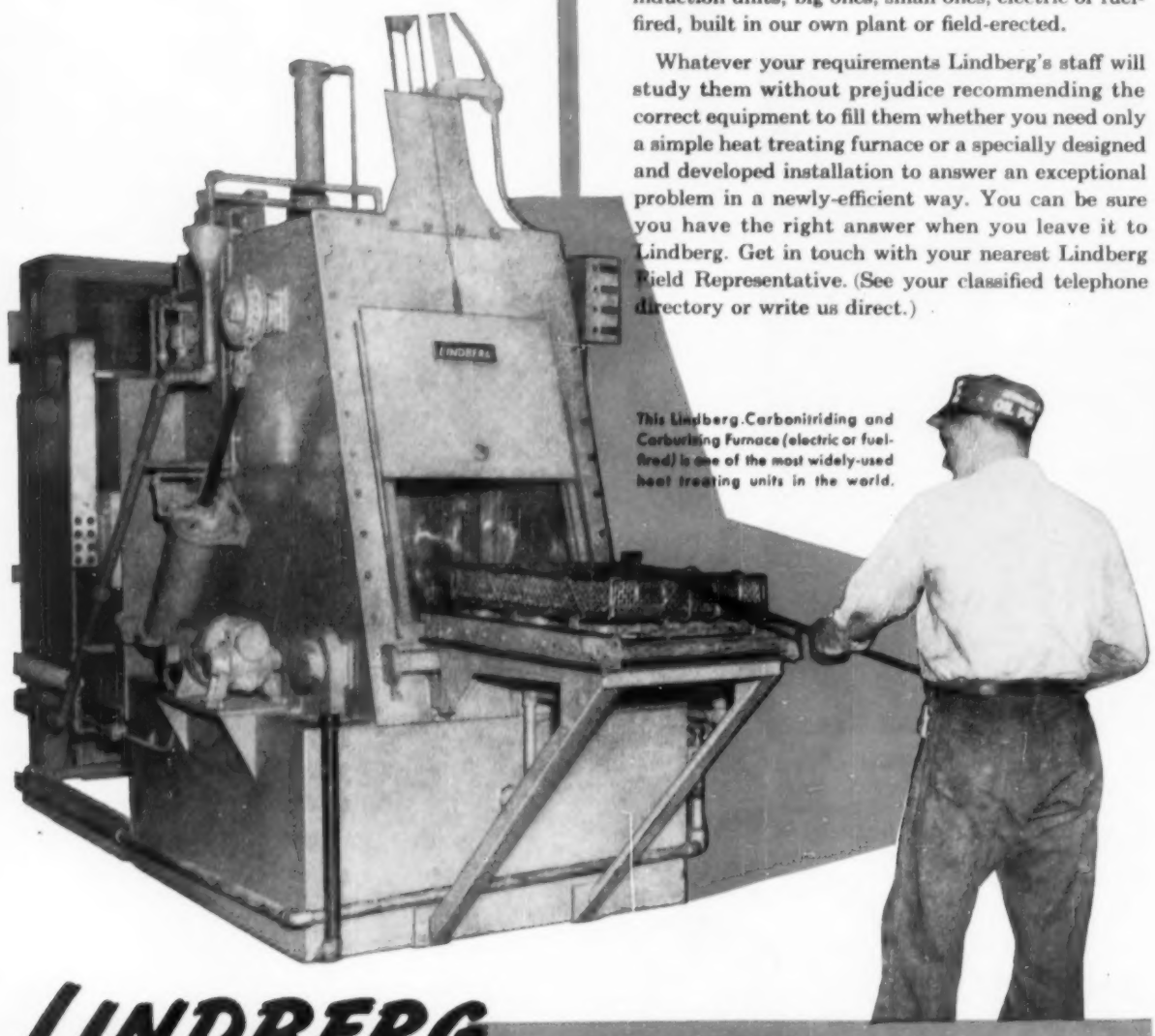
DOING THINGS BETTER BY DOING THINGS DIFFERENTLY

THE ONE BEST WAY TO SELECT HEAT TREATING EQUIPMENT

Talk it over with the most experienced furnace experts you can find

That is exactly what we can offer you at Lindberg. A design and engineering staff concerned only with the development of equipment for applying heat to industry. This staff produces the most complete line of such equipment in the industry—heat treating furnaces, melting furnaces, ceramic kilns, high frequency induction units; big ones, small ones, electric or fuel-fired, built in our own plant or field-erected.

Whatever your requirements Lindberg's staff will study them without prejudice recommending the correct equipment to fill them whether you need only a simple heat treating furnace or a specially designed and developed installation to answer an exceptional problem in a newly-efficient way. You can be sure you have the right answer when you leave it to Lindberg. Get in touch with your nearest Lindberg Field Representative. (See your classified telephone directory or write us direct.)



This Lindberg Carbonitriding and Carburizing Furnace (electric or fuel-fired) is one of the most widely-used heat treating units in the world.

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ENGINEERING COMPANY

2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.

Canada—Sivo Lindberg, Toronto

Carl Leistung, Tool Engineer, says:

"I LIKE GEOMETRIC TOOLS because . . .

. . . the line is so complete. If a threading job calls for an adjustable or collapsible tap, they have them from one inch to eight inches.

And, of course, their Die Heads have always been tops. I've tooled threading jobs all the way from aught-eighty to five inch pipe, and I've been able to get the right Geometric head every time, rotary or stationary.

In my book it's Geometric, period."

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

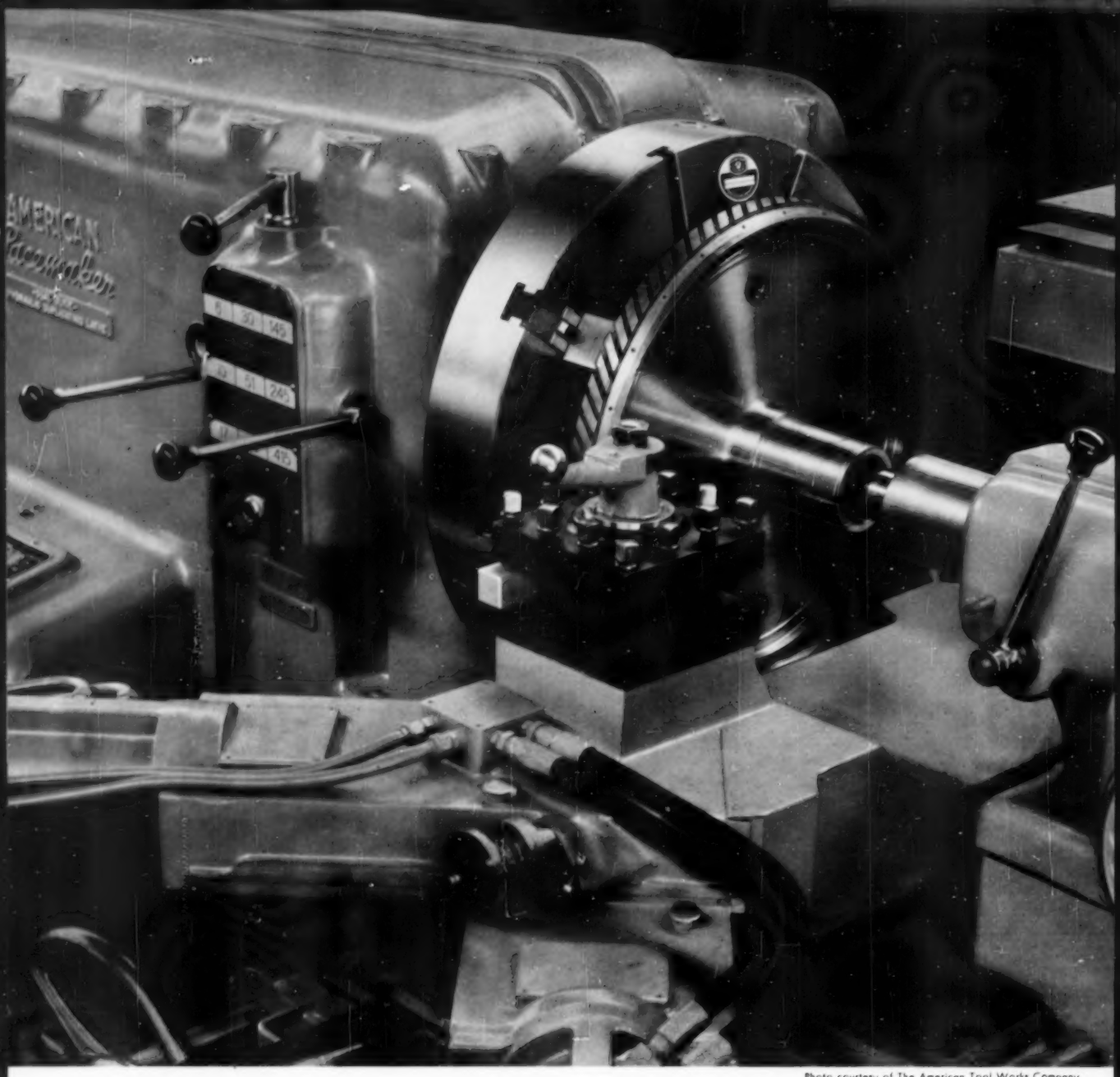

Photo courtesy of The American Tool Works Company

THE LATHE — *American Pacemaker 25" Style "G" Hydraulic Duplicating Lathe*

THE OPERATION — *Machining a jet engine compressor wheel*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
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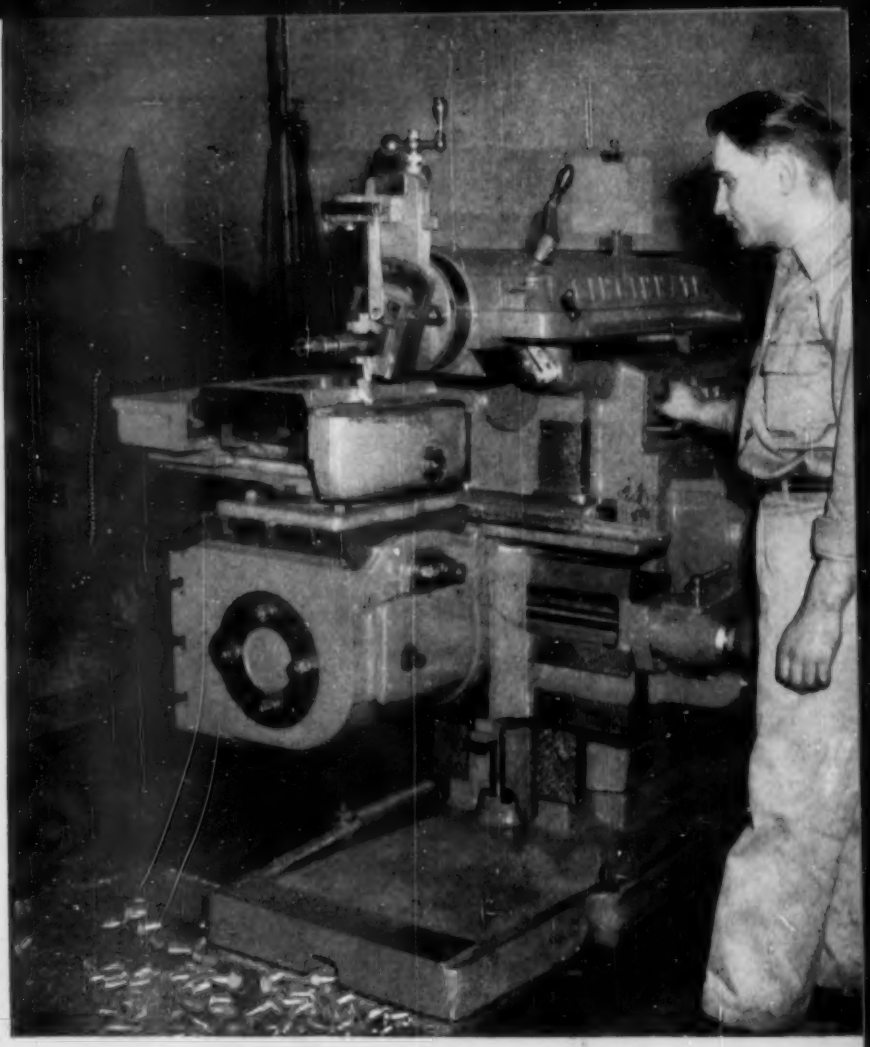
CHUCK

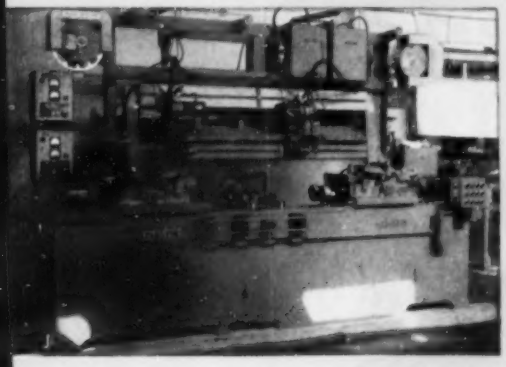
Call Your Horton Distributor Now!

Accurate heavy cuts by this Cincinnati Rigid Shaper

. . . at NATIONAL ELECTRIC WELDING MACHINES CO.

Bay City, Michigan





The steel slide being machined will be used on a National Automatic MIG arc welder, such as shown above.

Economical production of this steel slide for an automatic arc welder requires heavy cutting with maintained accuracy. The machine chosen for this job is a 16" Cincinnati Heavy Duty Rigid Shaper. Some of the features which make this performance possible are:

- Extreme rigidity due to heavily ribbed column.
- Exclusive Cincinnati 50 PSI pressure lubrication.
- Maximum accuracy due to extended ram bearing and slot-free ram.
- Fast, easy operation due to electro-magnetic brake and clutch with finger-tip control.

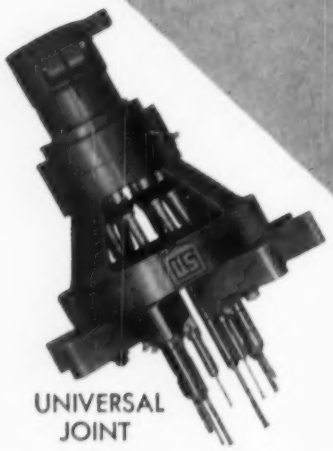
Write **Department E** for Bulletin "CINCINNATI RIGID SHAPERS". We also suggest you consult our Application Engineering Department on your machining problems.

Photos courtesy National Electric Welding Machines Co., Bay City, Michigan.

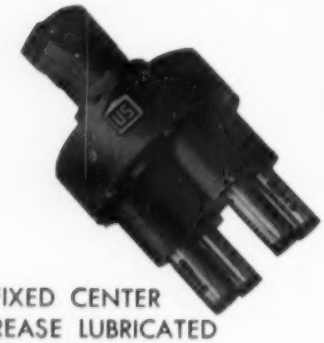
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS · SHEARS · PRESS BRAKES

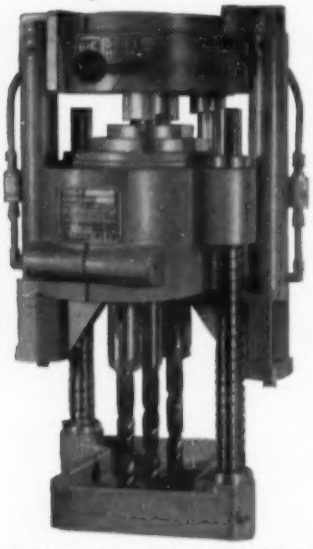
For men who know Drill Heads Best . . .
it's always
U. S. DRILL HEAD
5 to 1



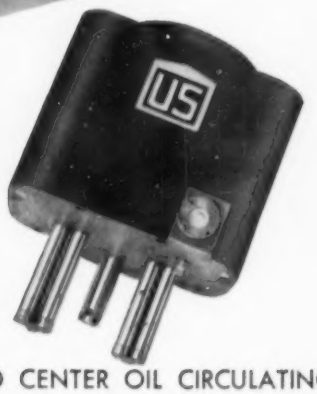
UNIVERSAL JOINT



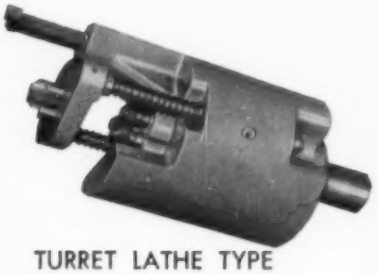
FIXED CENTER GREASE LUBRICATED



RADIAL SWIVEL ATTACHMENT WITH AIR COUNTERBALANCE

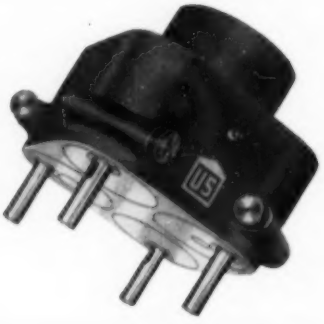


FIXED CENTER OIL CIRCULATING



TURRET LATHE TYPE

INDIVIDUAL LEAD SCREW TAPPER



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US DRILL HEAD

UNITED STATES DRILL HEAD CO.

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CTW
Carbide tipped slab broaches.
Partial view of a conventional round hole broach. Roughing, semi-finishing and finishing teeth are shown.
This solid carbide finishing shell fits on an arbor of a conventional round broach.
Surface broach with adjustable and replaceable carbide tipped tool bits.

Here's Why Continental Quality Broaches Actually Cost Less Than Ordinary Broaches

After all, the price paid for a broach may be only the beginning of broaching expense. To the original cost of the broach must be added the cost of work delays, scrapped parts, and time-consuming adjustments.

However, if the broach is free cutting, holds the required tolerances and finishes, with the maximum pieces per tool, your original cost may be your only cost.

Because Continental effectively combines quality materials, skilled craftsmanship, and engineering experience, it is a fact: "the best broaches cost less."

Continental
TOOL WORKS
Division of
Ex-Cell-O Corporation
Detroit 32, Michigan

56-64

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 260 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

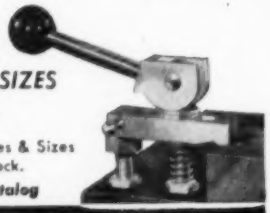
USE READER SERVICE CARD; INDICATE A-6-240-1

WESPO *for ALL* WORK-HOLDING *needs!*

TOGGLE CLAMPS 39 Types & Sizes

Note These Features—Reamed Holes—Hardened Serrated Bushings—High Tensile Strength Rivets

STANDARD FIXTURE CLAMPS *16 STYLES . . . 170 SIZES*



COMPONENTS

Over 1000 different Types & Sizes available from stock.

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The New SCHERR MICRO-PROJECTOR with the VERTICAL design

NEW 1957 SELF CONTAINED IMPROVED MODEL FEATURING

- ✓ RIGID FLOOR BASE - ELIMINATING EXTRA CHARGE FOR TABLE
- ✓ TILTING STAGE FOR HELIX, ANGLES AND BEVELS
- ✓ 4" DIA. STAGE OPENING
- ✓ COLUMN SLIDE ADJUSTABLE FOR WEAR BY MEANS OF GIBS - WILL HOLD SQUARE INDEFINITELY.
- ✓ CUSTOM MADE PRECISION COATED LENSES & DOUBLE CONDENSERS FOR DIFFERENT OBJECTIVES 10 TO 100X MAGNIFICATION.
- ✓ AN ENTIRELY NEW PRACTICAL DESIGNED TOOL FOR INSPECTION DEPARTMENT AND PRODUCTION SHOP.

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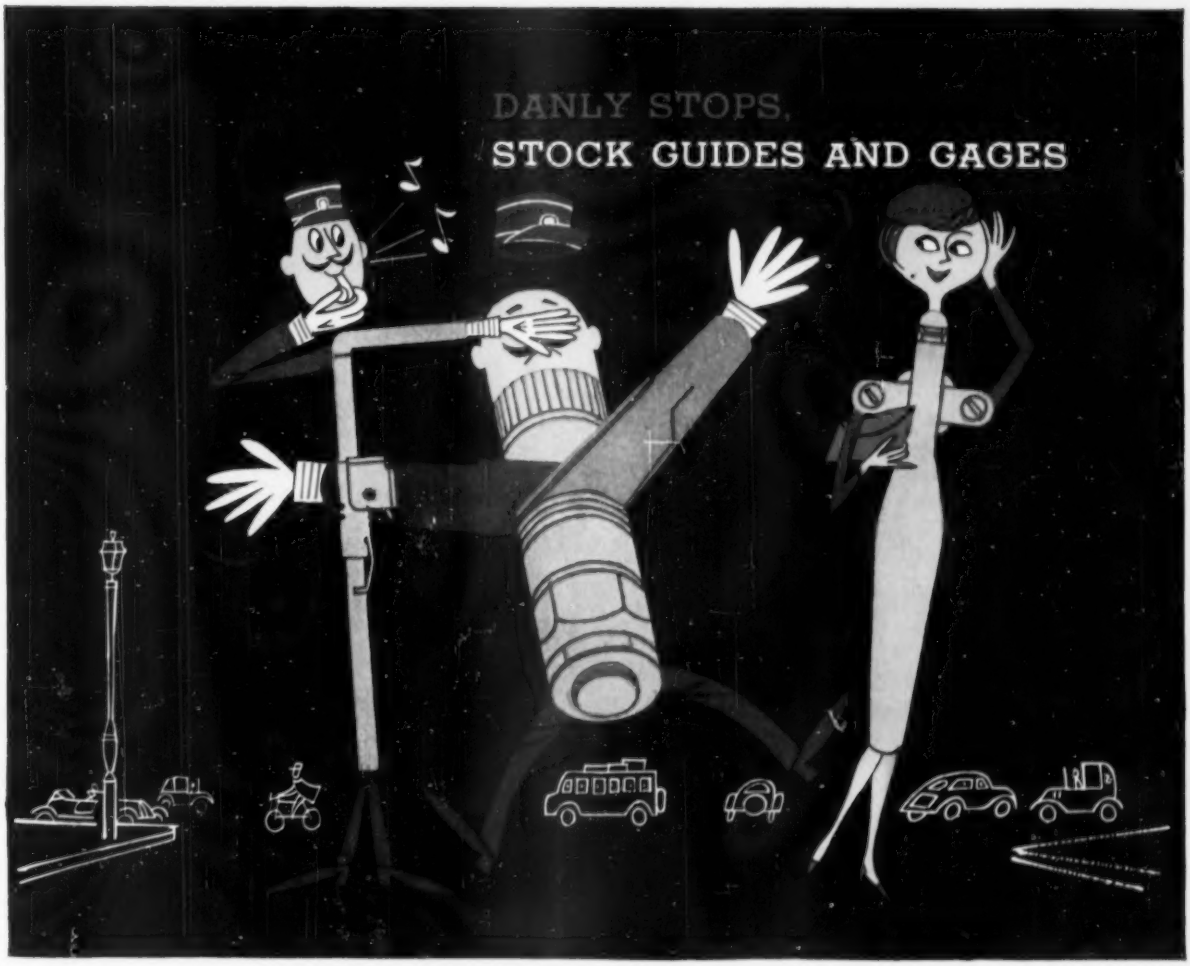


Die Stops

Auto Gages

Stock Guides

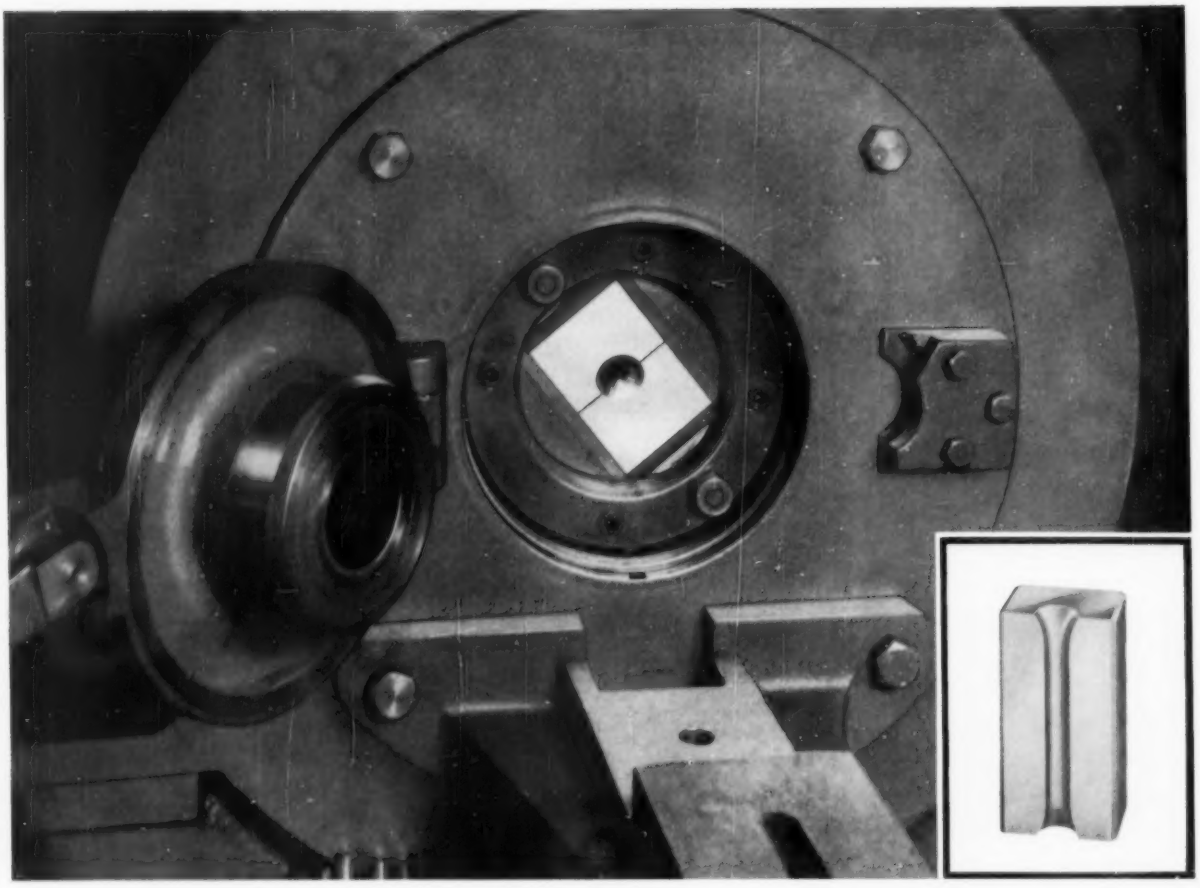
SAVE DIE MAKING TIME, SPEED PRODUCTION

You can depend on these Danly stops, guides and gages for effective control of stock in high speed stamping. The Danly Universal Automatic Stop provides a completely automatic method for stopping stock just prior to the piercing, shearing or blanking operation and reduces necessary scrap allowance. Automatic and primary stops are available in three sizes each. Rugged, easy-to-install Roller Stock Guides and Guide Rails provide accurate guiding of strip and coil stock. They are available in two sizes – one for use with small dies, the other for use with large dies. The Danly Auto Gage can be adapted to any die and operates effectively as an automatic die stop.

Because of their versatility and wide adaptability, Danly Stops, Guides and Gages find wide application by eliminating the need for hand-made units . . . providing new savings in time and costs. They are available from stock at leading industrial distributors and Danly Branch assembly plants in all major toolmaking centers.

DANLY®

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois



KENNAMETAL* Dies swage up to 50 times more pieces than steel

with more accurate dimensions and better quality

By switching to dies made of Kennametal Grade K90, a manufacturer of hand tools has obtained these important benefits on a hot swaging operation:

- increased production of swaged steel alloy rods from 100 to 1000 pieces between dressings . . . machine down time greatly reduced.
- swaged pieces are now more uniform and of better quality.
- the Kennametal dies are outlasting the steel dies 30 to 50 times.

Although the Kennametal die blocks cost about five times more than the steel dies previously used, they quickly pay for themselves and show substantial profits on the investment.

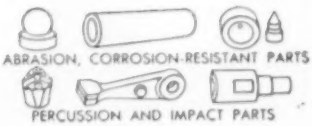
As Kennametal dies and die sections are showing similar results on many types of operations, why not select Kennametal for your next die parts . . . for blanking, compacting, cold heading, cupping, drawing, forming, perforating, piercing, slitting, stamping or swaging.

You can choose from Kennametal's "90 Series" with six grades or the exclusive non-galling "80 Series" with three grades. These grades provide a range of carbides that meet the specific requirements of any die application.

A Kennametal die engineer will gladly work with you or your die maker in applying the right grade of Kennametal for your dies. Call him at your nearest Kennametal office or write to KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

INDUSTRY AND **KENNAMETAL** *...Partners in Progress*



Cracked shaft in Valdosta . . . **His job: get a new one down to Georgia by tomorrow noon.** It's an emergency case, but it's not as tough as it sounds.

He's backed by the press industry's largest parts department . . . by a million dollar parts inventory in two plants . . . by telephone and teletype tie-ups between Parts Headquarters in Hastings, Michigan and Toledo and local sales and service centers throughout the country.

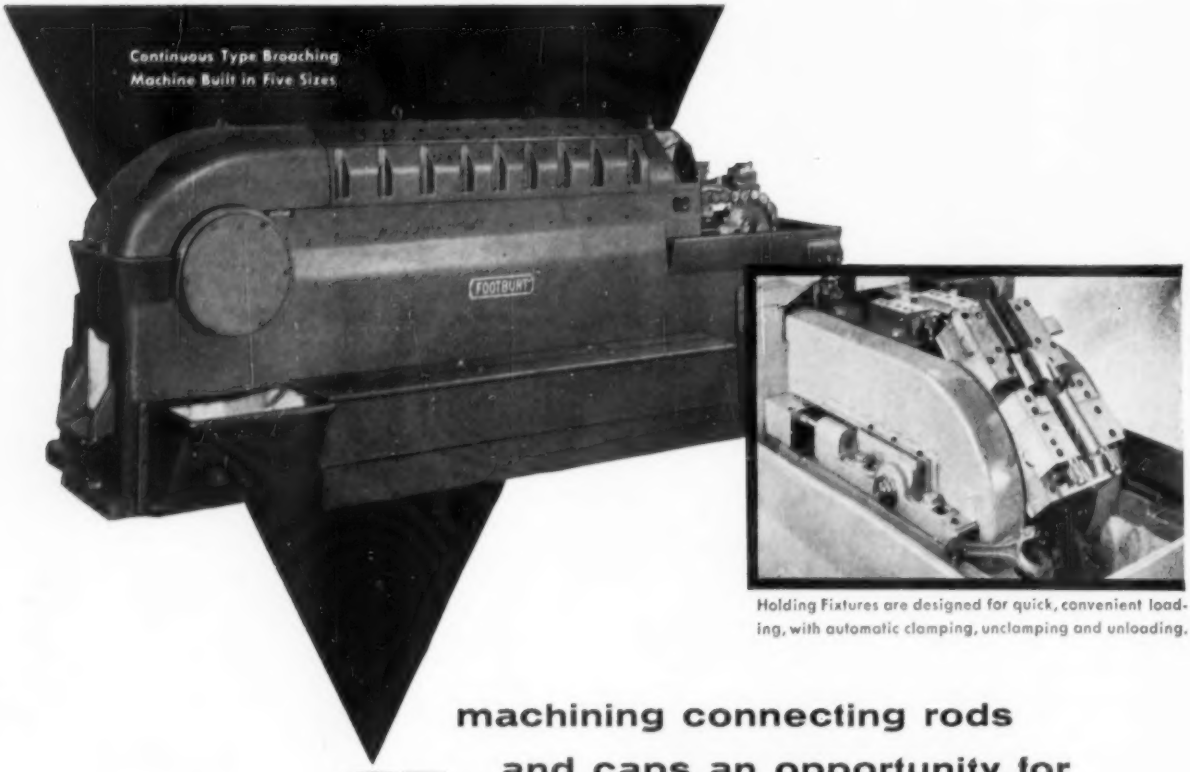
Which is another reason why we say, "Bliss is more than a name . . . it's a guarantee."

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

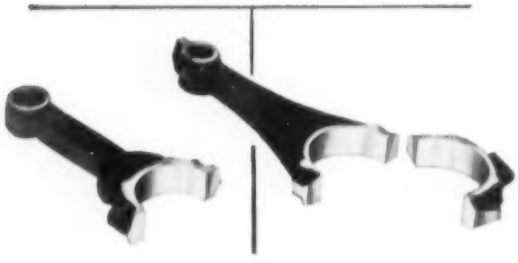
PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE



Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.

machining connecting rods and caps an opportunity for

Surface broaching



Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footburt Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

THE FOOTE-BURT COMPANY CLEVELAND 8, OHIO

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

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PIONEERS IN SURFACE BROACHING

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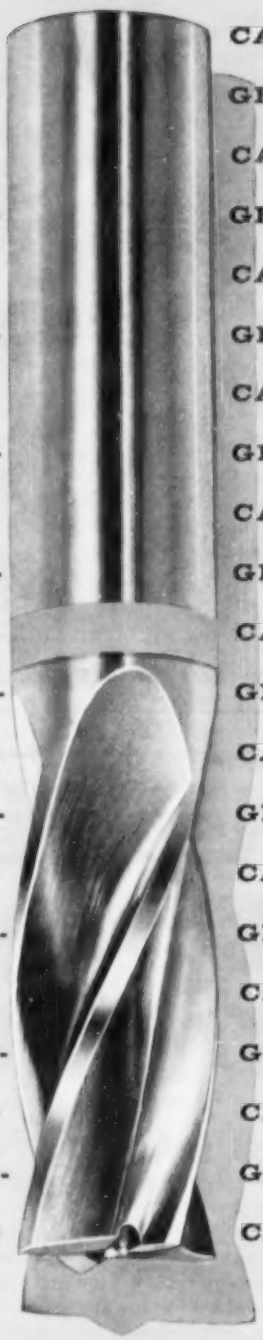

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hours

of

useful

life

Elgin GOLDEN CIRCLE Carbide End Mills have sharp, smooth, hard cutting edges that LAST—and make your toughest jobs look easy! How come? First, they're solid carbide, of course. But most important, they are finished by Elgin's new Electro-Grind Process.

Electro-Grinding eliminates checked, chipped or flaked cutting edges caused by the strains and high temperatures of other production methods. With the extra fine grit wheels used by Elgin, Electro-Grinding assures the sharpest, smoothest cutting edges yet.

Use Elgin Golden Circle Carbide End Mills for more production hours between regrindings, for greater accuracy and lower tool costs. Write today for the complete new catalog. It shows Elgin's complete line of solid carbide end mills, drills, reamers and burs—all in stock for immediate delivery.

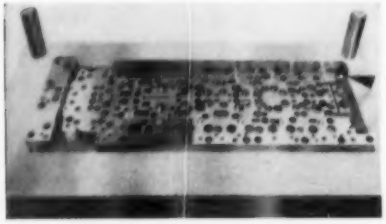
Abrasives Division
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

ELGIN "Electro-Grinding" Makes the Most of Solid Carbide

Holes

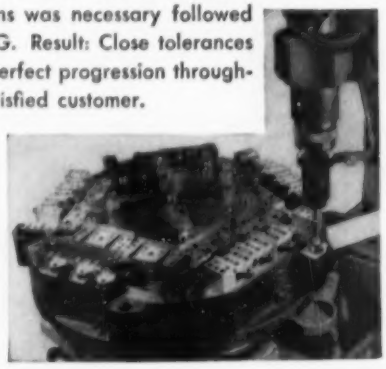
JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.



Borrow our instructive 11 minute movie on Jig Grinding.

A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

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Wide variety of hole and rod sizes, lengths and deflections. Increased fatigue life. Reduced down time. *Write for specifications and price list, and name of nearest distributor.*

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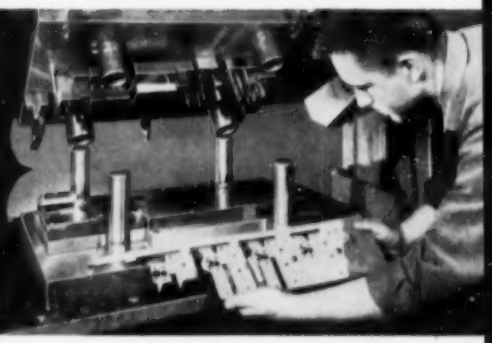
Using "free machining" Olympic FM (D-2 type) die steel...

Middlestadt Machine Co., Baltimore, Md.

. . . saved over 100 machining hours on this die!

Six station progressive die

. . . saved over 70 machining hours on this die!



Five station progressive die

In the manufacture of these long-run dies, used to produce brackets for hanging venetian blinds, the Middlestadt Machine Co. reported a savings of 15% in the machining times. This savings, attributed to the "free-machining" characteristics of Olympic FM, was important because the total machining time approximated 1125 hours.

In addition to these savings, Middlestadt, one of the largest precision die shops in the mid-East, also noted these additional advantages of Olympic FM: (1) full uniformity in the steel; (2) excellent non-deforming characteristics during heat treatment; (3) large range of stock sizes available for fast delivery.

Use Olympic FM high carbon-high chromium die steel *for long run dies...*

. . . and you, too, can effect savings in machining time while gaining outstanding performance advantages. These plus factors are a direct result of Latrobe's exclusive DESEGATIZED® process of manufacture where the carbide particles and alloy sulphides are uniformly dispersed throughout the steel.

Over 250 sizes of Olympic FM are readily available from ten conveniently located warehouses . . . Call your Latrobe representative today!

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...increases wheel life

● *More power per pound* is the reason why the new *Rotor B-7 Vertical Grinder* does jobs faster. *Application:* Grinding flash and parting lines on cast machine parts. Replaced flexible shaft grinders. *Result:* Boosted output 33%. Savings will pay for the new *Rotor B-7 Vertical Grinders* in 17½ weeks. Operator fatigue is less. Wheels last longer. Downtime now nil.

The nearby Rotor Application Engineer will demonstrate these or other new Rotor Tools on *your* jobs. Write for Bulletin 56 on Rotor Vertical Grinders. The ROTOR TOOL Company, Cleveland 32, Ohio.

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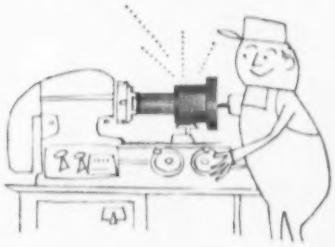
Saving all you can on

Production Bronze Castings?

Here?

Here?



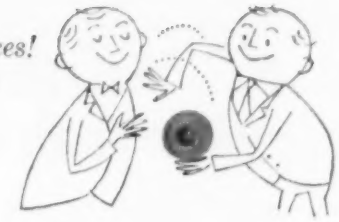
A

You do, with

Ampco Shell Moldings!

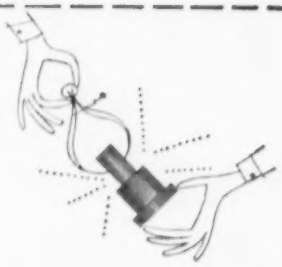
Smoother cast surfaces!

Often, smooth enough to use as is.



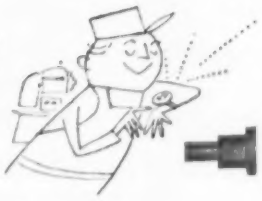
Closer tolerances!

Most castings held to ±.015 — favorable shapes, ±.010.



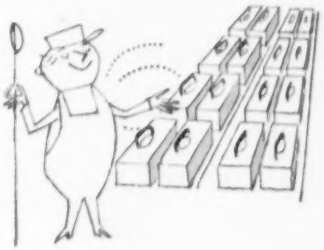
Less machining!

In some cases, finishing operations are eliminated.



Lower cost!

High-speed, semi-automatic mold production means foundry economy.



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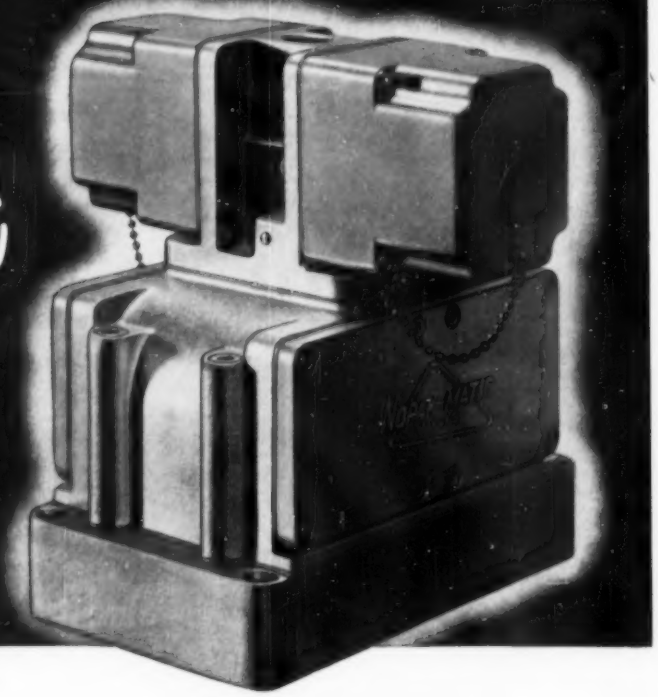

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CATALOG 105 describes all the NOPAK-MATIC Plus Values in detail, gives complete installation and parts data. Send for your catalog now and it will be forwarded promptly. NOPAK-MATIC *Plus Value* Valves are available in ¼", ⅜", ½" and ¾" pipe sizes for 2-, 3-Way Normally Open or Normally Closed or 4-Way operation with master (air), single or double solenoid pilot control heads.

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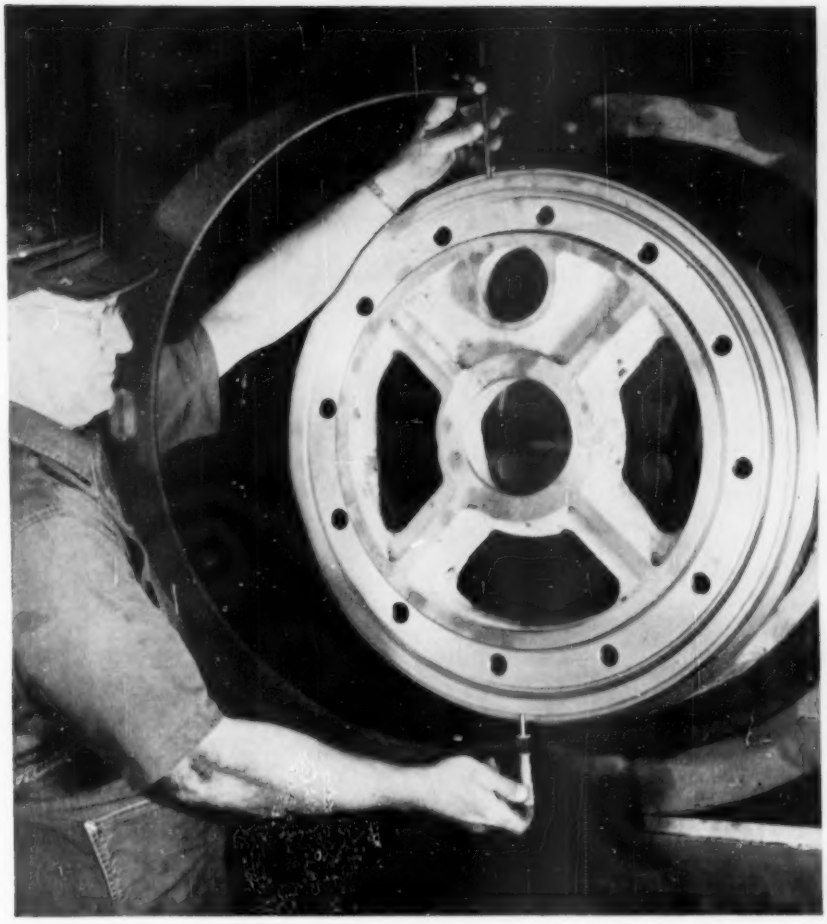

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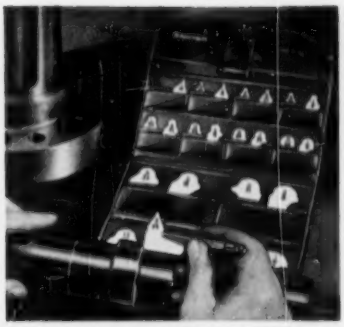

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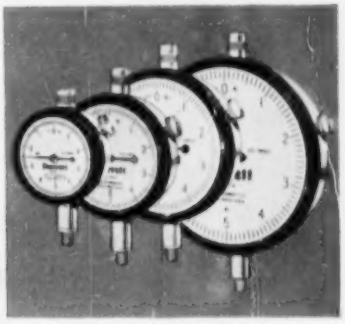

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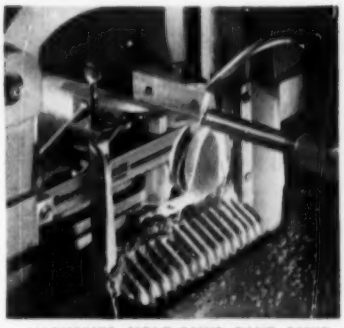

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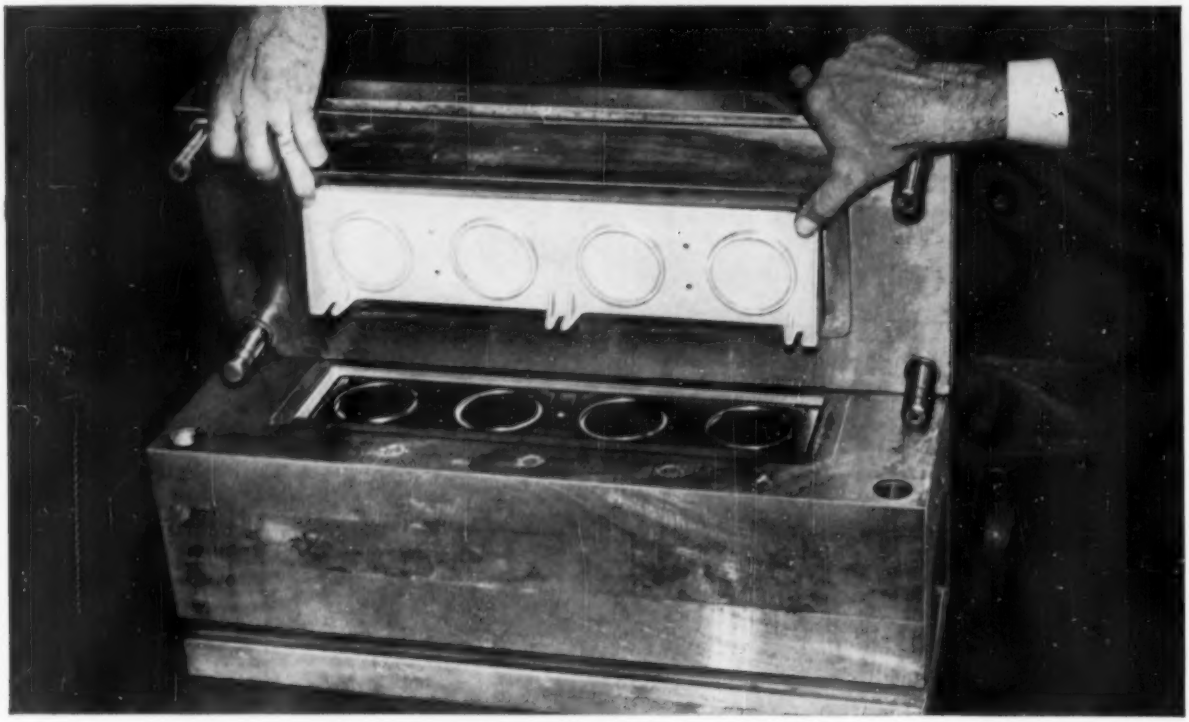

Unique, "spin-out" mold, shown at Leaf Plastics, Yonkers, N. Y., pioneers in this type of injection molding.

UHB-151 Tool Steel Meets Severe Demands Of "Spin-Out" Injection Mold

More and more die makers are solving their difficult job needs with Uddeholm tool steel. The interesting injection mold above is a good example. It produces a high impact styrene utility shelf with four, threaded jar caps. Making such a mold required a tool steel of exceptional quality.

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Uddeholm's Swedish-quality tool steels will prove an asset to *any job*. Why not take advantage of them for *yours?* Stocks include over 2800 combinations of size, shape, grade and finish. A telephone call will start your steel on the way.

Plastic "Wonder Shelf" sold by Goodman Bros., Inc., Meriden, Conn.

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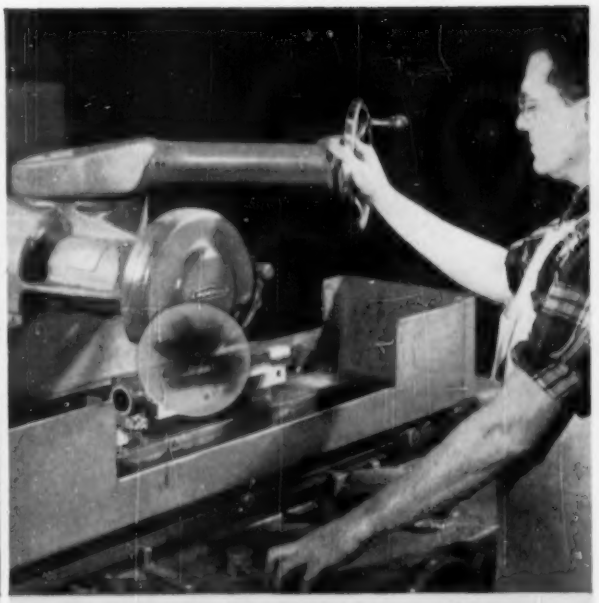

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Remember: only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost. See your Norton Distributor for further facts on how the G Bond and 32 ALUNDUM abrasive combine to form the best "Touch of Gold" team for grinding high speed and alloy steels. (For other applications investigate other Norton ALUNDUM and CRYSTOLON* abrasives.) Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

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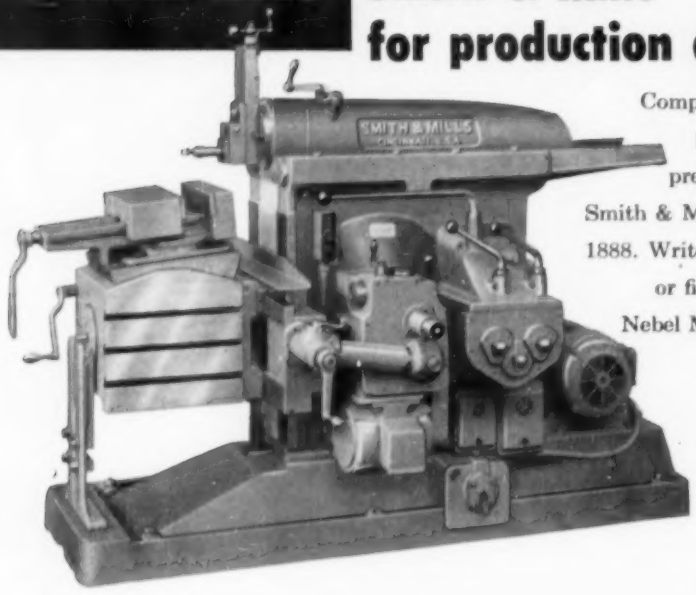

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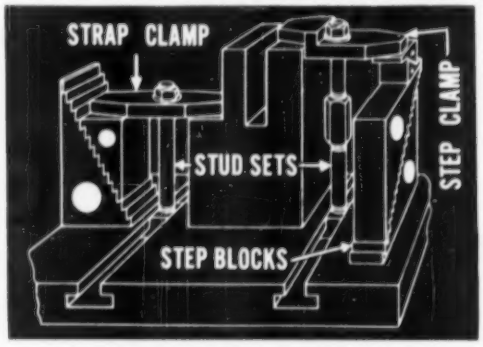

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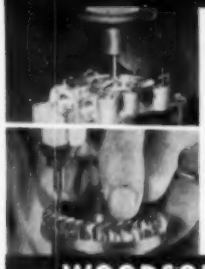

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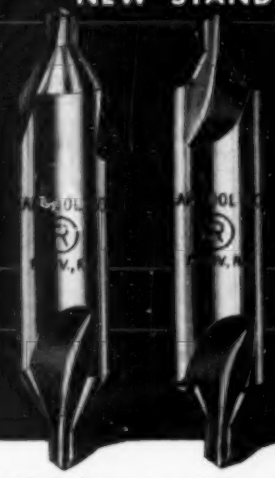

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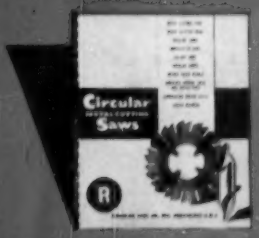

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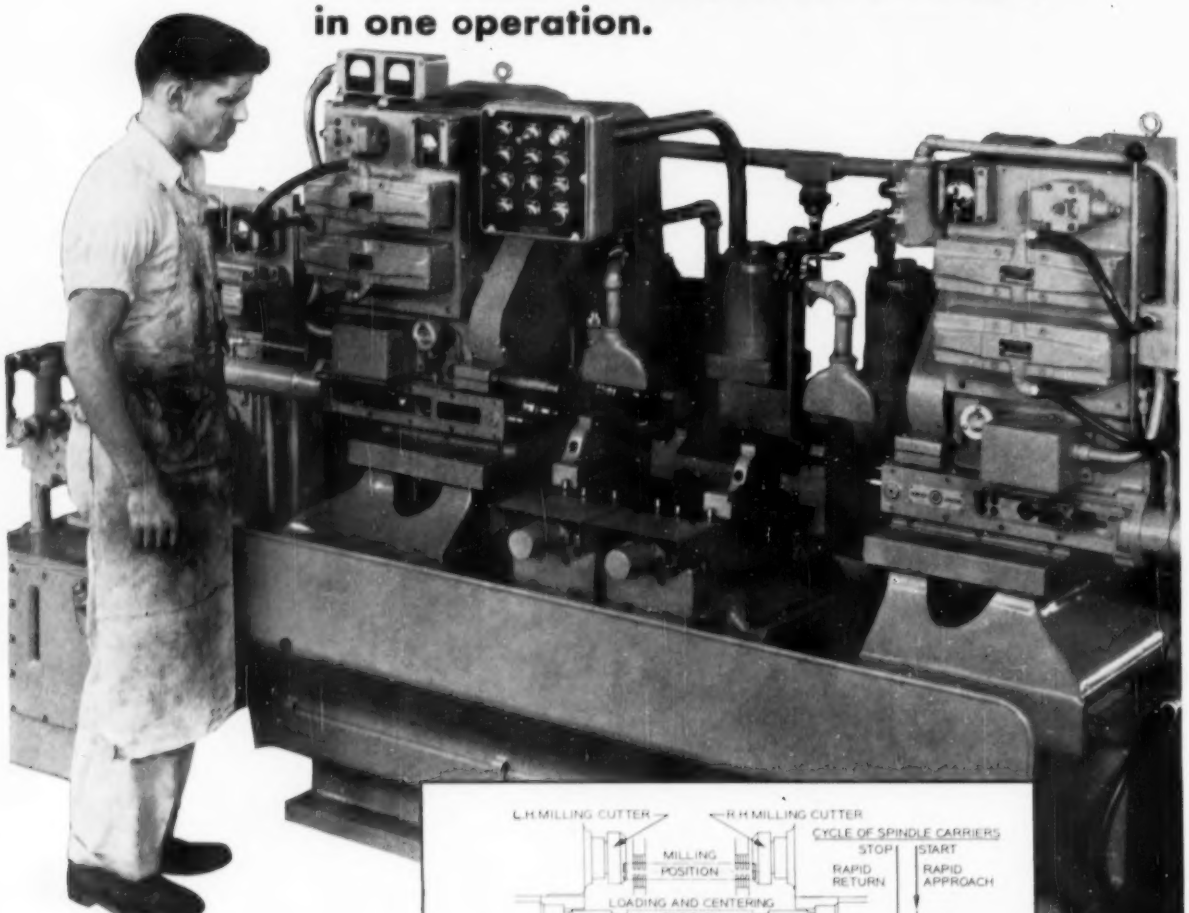
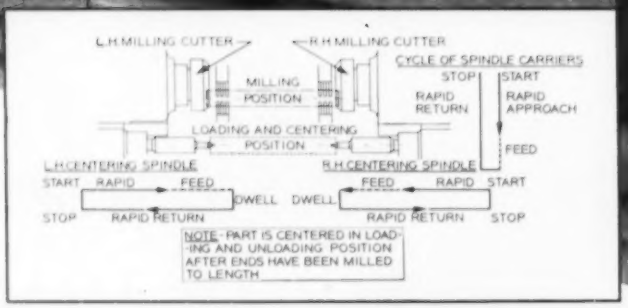
Prepare your shafts for MORE ACCURATE TURNING

. . . by milling to length and centering in one operation.

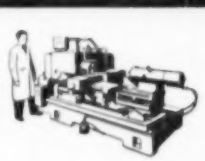




Sundstrand's **DOUBLE END CENTRMIL** has fast, accurate adjustment for various lengths and diameters of parts. Sketch shows tooling and cycle.

SUNDSTRAND "Engineered Production" Service"

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



Maintaining a definite relation between the ends and centers is automatically controlled on Sundstrand machines for squaring ends and centering shafts. This is of particular importance in preparing shafts for tracer turning. Combined milling and centering is more accurate than conventional methods as it isn't necessary to re-chuck the work between the milling and centering cuts, and the centers are held square with the end of the shaft. Combining the operations also saves the handling time and the floor space ordinarily required for a second or more expensive machine. In addition to being accurate, the CENTRMIL is fast. Three basic types, a SINGLE END CENTRMIL, a DOUBLE END CENTRMIL, and a DOUBLE END BROACHING and CENTERING MACHINE are available.

The DOUBLE END CENTRMIL has fast, easy adjustment making the machine ideal for both long and short parts in long or short runs. The automatic cycle of Sundstrand CENTRMILS can be combined with automatic loading and unloading for parts like automotive camshafts and similiar high production jobs.

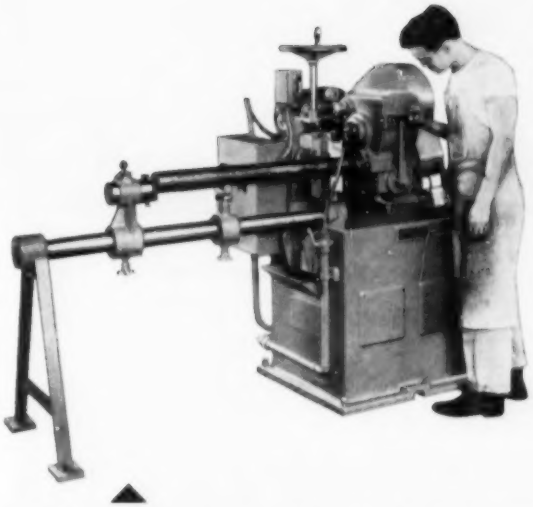
The SINGLE END CENTRMIL is ideal for the steel stock room or lathe department for miscellaneous small lot shaft work. Just a few simple adjustments and the machine is ready for individual pieces or small lots.

DOUBLE END BROACHING and CENTERING MACHINE provides the most practical machine for extremely high production. Low cost of tool per piece and high rate of production makes broaching the most economical method for high volume work.

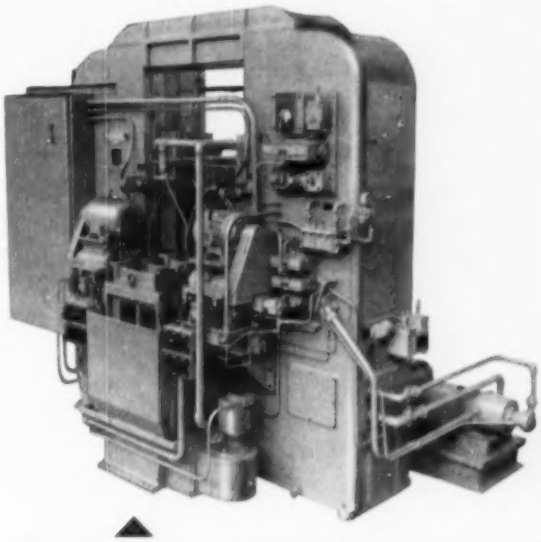
INCREASED PROFITS...

through improved accuracy and increased production are yours when you apply Sundstrand "Engineered Production" to your shaft work. More details are available in Bulletin 780.

WRITE FOR YOUR COPY TODAY!

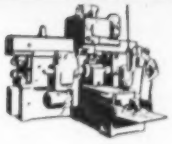


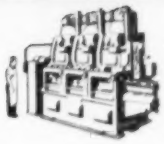
A typical example shows one manufacturer using a SINGLE END CENTRMIL, saving 65 out of 105 minutes on a lot of 40 pieces compared to previous method of facing to length and centering



BROACHING and CENTERING machine handles main transmission shaft forgings, two at a time, at the rate of 326 per hour.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

"Engineered Production" Service

FOR BROACHING

It takes all 3

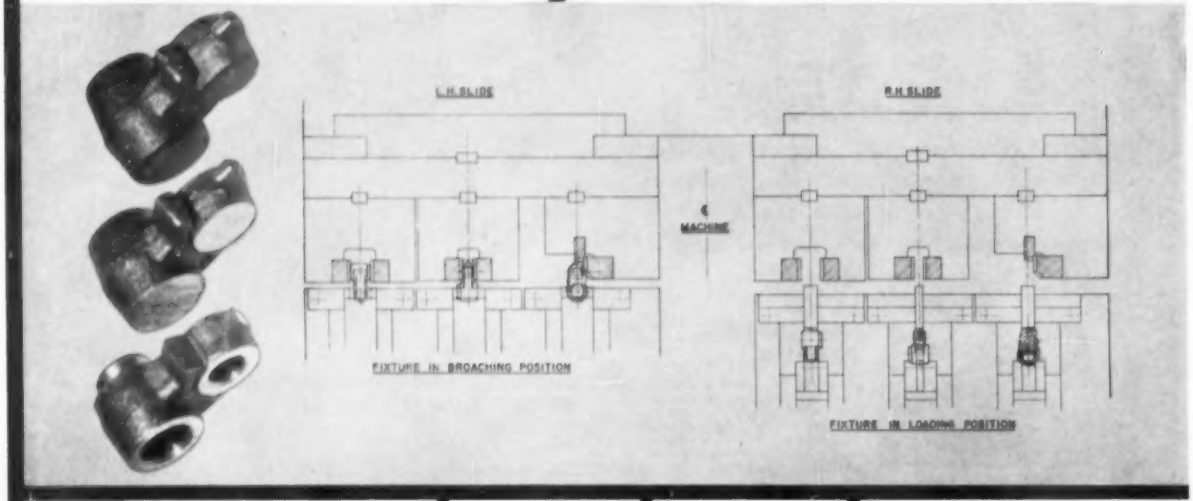
American's *"Engineered Production"* Service . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

THE JOB — Three operations required: (1) Straddle broaching hub ends; (2) Straddle broaching toggle pads; and (3) Broaching vee notch and end surface on pawl end of lever. Parts are forged SAE-1018 steel levers for transmission parking pawl toggles.

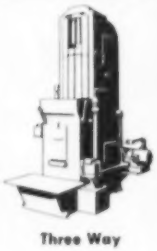
THE RESULT — 250 completed pieces per hour. Two hydraulically operated, tilting-type receding tables are used to hold six parts on a dual ram surface broaching machine.

1 PROPER BROACH TOOL DESIGN

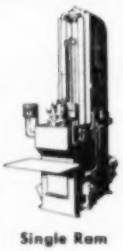
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish tolerances required, etc. High-quality work and long tool life result because broach and machine are designed to operate as a team. A single pass of either multiple tooled ram on this machine performs three different broaching operations on three parts.



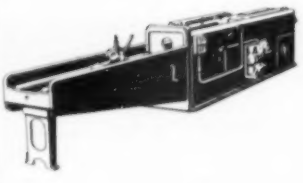
Broaching Tools



Three Way



Single Ram

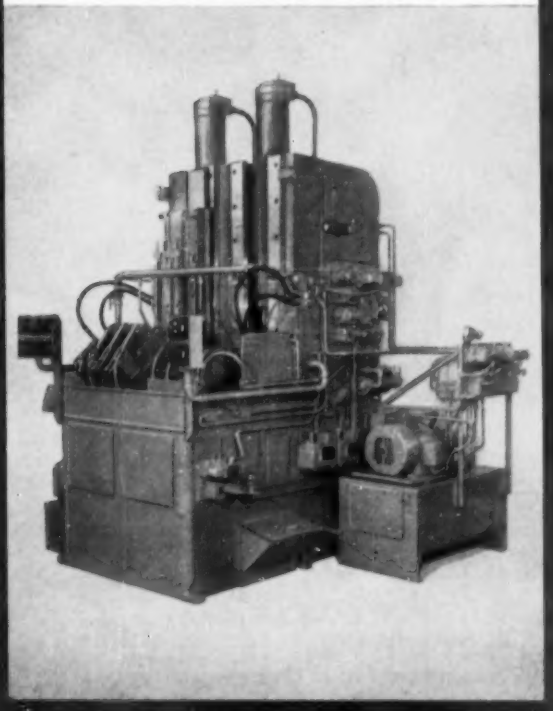


Horizontal

to give you peak broaching performance

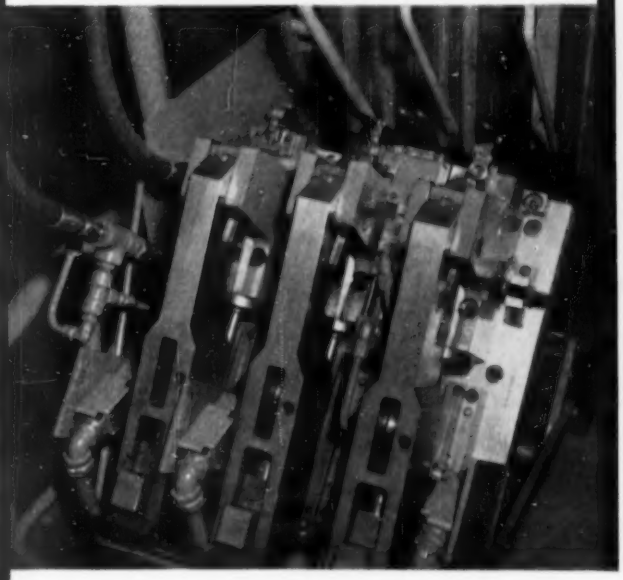
2 SPECIFYING THE RIGHT MACHINE

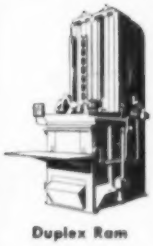
Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc. determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. The vertical hydraulic dual ram surface broaching machine shown, provides a separate hydraulic circuit for clamping, which is electrically interlocked with machine cycle for fast automatic operation.



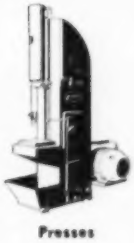
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Close-up, showing LH fixture only, has three parts in place ready to be broached. Fixturing on the RH ram is identical. One fixture is unloaded and loaded during the broaching stroke of the other ram, providing the most practical method. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.





Duplex Ram



Presses

For more information on practical broaching methods, write for Bulletin A715.

SUNDSTRAND

American

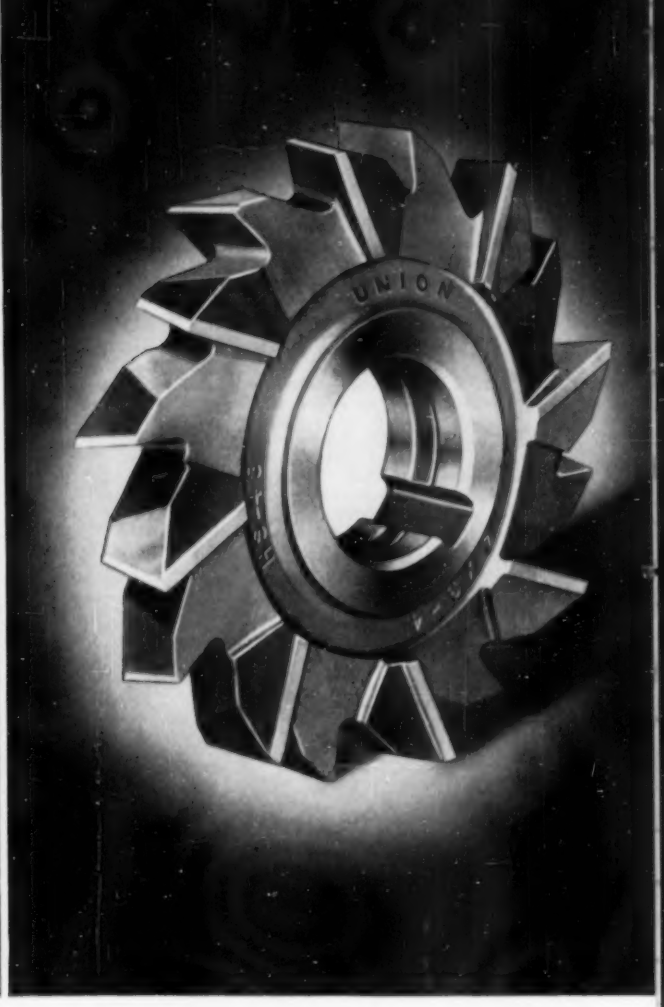
BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

If your cutters pile up chips as fast as bulldozers pile up earth...

This brand cuts down your cutter usage, production time and costs!



The more cutters you use, the more you need Union

Union manufactures milling cutters, gear cutters, drills, end mills, reamers, hobs and carbide tools. Available nationally through Union Distributors and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco. S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vermont.

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

This is the scrap pile for a run of 400 Class 5 tolerance screws

Four minutes' worth of on-the-spot inspection on a Kodak Contour Projector tells operators how five critical tolerances of their work measure with company standards. Result—a reject rate of ¼ of 1 per cent.

The Chicago Screw Company, Division of Standard Screw Company, produces threads to Class 3, 4, and 5 tolerances—fine or better—for automotive, aircraft, and farm machinery makers.

Screws have tolerances of .005″ lead error to fit a .002″ dimensional tolerance gauge; .002″ pitch diameter tolerance; and 15-minute tolerances on flank pitch.

Kodak Contour Projectors make it easy for operators to run rapid routine quality checks. Highly trained inspectors check operators' quality control reports and spot-check production.

When a tolerance question comes up, the accurate answer again comes from a Kodak Contour Projector. In about four minutes, operators check out a thread completely, including pitch diameter, lead error, pitch, depth, and helix angle to tolerances well within .001″. As a result, *the reject rate in the firm's threading division is down to an average of ¼ of 1 per cent.*

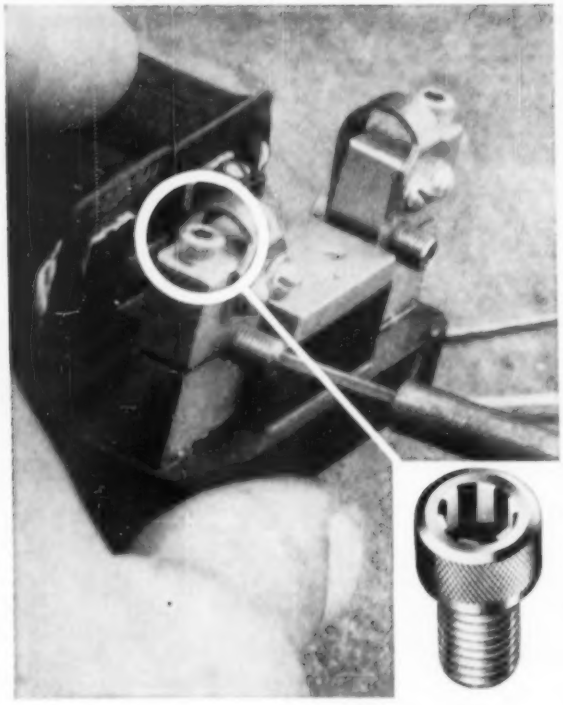
A Kodak Contour Projector can be the way for *you* to keep tolerances profitably tight on mass production runs. It can also be the way for you to improve inspection accuracy and speed—while lowering your inspection costs. Send for the booklet "Projection Gaging with Kodak Contour Projectors." Write to:

Kodak Contour Projector, Model 14-2A—a versatile, precision measuring projector for toolroom or production line.

Apparatus and Optical Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK



They called off test after 20,000,000 operations...

The Bristol Multiple-Spline socket screw still held fast though customer engineers had expected only 2,000,000 operations!

The screw locked and held critical contact adjustment to 0.001" in an ultra-reliable polar telegraph relay. Test was run by the manufacturer, Automatic Electric Company, Chicago, makers of telephone and communication equipment and electrical control devices for industry.

During the 20,000,000-cycle life test, the 0.006" contact space did not exceed the 0.001" allowable tolerance. This was made possible by the Bristol cap screw which locked the adjustment screw in place. This relay—using 4 Bristol socket screws in all—not only has to hold adjustment under operating shocks, but has to operate reliably under extremes of temperature and humidity in outlying railroad telegraph stations. The Bristol screws assure easy adjustment or disassembly when needed.

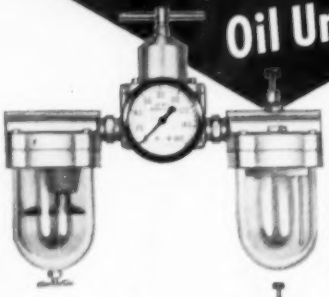
Reports like this are typical of the outstanding performance Bristol socket screws are giving hundreds of manufacturers of fine products—ranging from electric razors to guided missiles.

Bristol offers the most complete line of socket screws on the market. Hex socket screws—the industry standard—as well as Multiple-Spline. Cap, set, and with every style of point. Sold through leading industrial distributors. Ask for complete data on them today. A-7-1

Precision socket screw manufacturers since 1913
Bristol's Hex Socket Screws
Bristol's Multiple-Spline Socket Screws
Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½".
THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-6-264-1

AIR-MITE FILTER—REGULATOR Oil Unit



- Instantaneous response to demand
- Special Filter for cleaner air
- Accurate injection of pre-atomized oil

The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life. Operates at pressures to 160 psi. Available in ¼", ⅜" and ½" T.P. sizes. Individual units available separately.

Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator – Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter – Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

AIR-MITE

4407A W. KINZIE • CHICAGO 24, ILLINOIS

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Simple Design... Rugged Construction

WELLS HORIZONTAL METAL CUTTING BAND SAWS

The simple design and rugged construction of every "Wellsaw" didn't just happen. We planned it that way! Over 30 years of specialized band saw experience and know-how is your assurance of the quality and service with each machine produced by Wells Manufacturing Corporation.

There is a Wells Saw of the right style, capacity and speed to do a better, more economical job for you. Wells Saws will deliver long, dependable service. Operating and maintenance costs are very low. See your Wells Distributor.

Wellsaw

Wells

The Pioneers of Horizontal

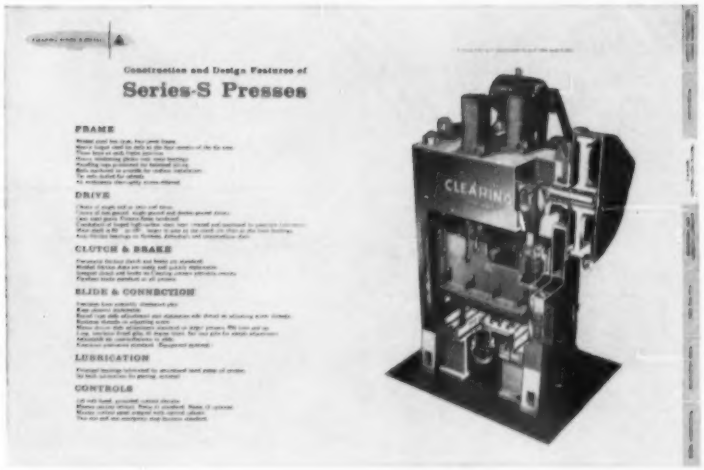
METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
600 Service Road, Three Rivers, Michigan

USE READER SERVICE CARD; INDICATE A-6-264-3

what you should
know about

CLEARING
S-TYPE PRESSES


Construction and Design Features of
Series-S Presses

FRAME

DRIVE

CLUTCH & BRAKE

SLIDE & CONNECTION

LUBRICATION

CONTROLS

it's all in this **new**
CLEARING CATALOG

Here are all the vital statistics of Clearing's line of crankshaft Series-S presses. These presses give you the capacity and rigid construction for all types of drawing and heavy blanking operations, the precision that's required for progressive die work and lamination production. All the facts on these moderate priced, versatile machines are given in a colorful new 48 page catalog—complete specifications and full, accurate descriptions of construction and features.

Write for it today. We'll send it without delay.

CMC CLEARING

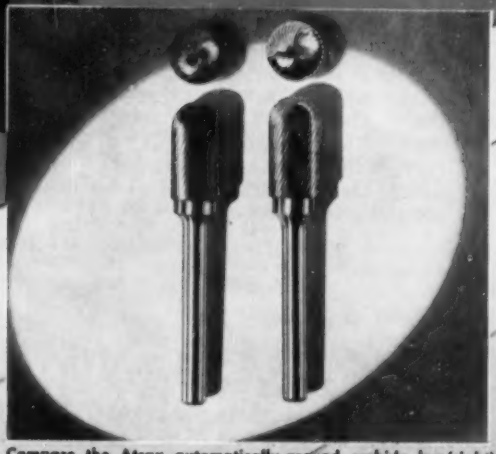
CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION *Division of U. S. INDUSTRIES, INC.*

6499 WEST 65th STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT, HAMILTON, OHIO

NOW *Carbide Burs are* EXPEN



Compare the Atrax automatically-ground carbide bur (right) with the manually-ground bur (left). Note the accurate, uniform fluting, sharp cutting edges and gem-like finish of the Atrax bur.

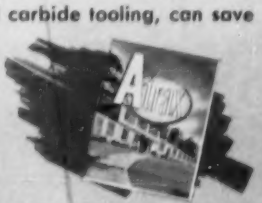
DABLE!

Automation By Atrax

Manual bur grinding is obsolete. It is a tedious operation, costing much more than Atrax automatic grinding. Flute uniformity depends entirely upon the skill and patience of the operator.

For the first time in the history of metalworking, carbide burs are being produced completely automatically! The manually-ground bur, costing 10 to 20 times more than high speed steel, is obsolete. Exclusive Atrax automated grinding is many times faster than hand grinding . . . cuts time and labor costs so low that Atrax Carbide Burs are now expendable tools!

Manual bur grinding is an expensive, time-consuming operation, much less accurate than Atrax automated grinding. Atrax Automatic Bur Grinders produce precision carbide burs—eliminate human error—insure absolute uniformity of bur size, shape, concentricity and fluting. Automated bur grinding is an exclusive Atrax development—proof again that Atrax, the leader in solid carbide tooling, can save money for every user of carbide and high speed steel burs!



Send for the new Atrax Catalog listing more than 850 standard Carbide Burs . . . products of Automation by Atrax.

THE ATRAX COMPANY • NEWINGTON, CONN.

ANOTHER GREAT TIP FROM OUR MADISON MAN!

GUN DRILLS FOR CONVENTIONAL HOLES!

"He told us they'd be **faster** and they are . . . We're doing the operation in less than half the time. He said we'd need **fewer passes**, and he's so right . . . we now get a **finished hole** with *one pass!* Our tolerances are closer and our surface finish better than ever before . . . in less time and at much lower cost."

If you are interested in cutting conventional drilling costs with Madison Gun Drills, **write** for our new literature that tells exactly how. And let your Madison man advise you on other hole problems, too. He'll advise the **right** tools for every job. He **knows** 'em all – because he **has** 'em all! *For further information write Dept. TE-4.*

Let the man with the holes in his head tell you how to cut costs in:

- ★ **Boring**
- ★ **Reaming**
- ★ **Deep Hole Drilling**
- ★ **Trepanning**
- ★ **Roller-Burnishing**
- ★ **Gaging**

MAIL COUPON TODAY

Dept. TE-4

☐ Please send me literature on Madison Gun Drills.

☐ Have representative call.

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Inner Diameters Are Our Business

MADISON INDUSTRIES INC.

Muskegon, Michigan

ASSOCIATED WITH MADISON — FAESSLER TOOL CO.

what's the latest news in induction heating?

the new Cincinnati inductron!

Cincinnati's new Inductron® induction heating machine is *new all the way through!* It offers more advantages in performance, flexibility, ease of operation, control and maintenance than any similar equipment previously available to industry for rapid selective surface hardening, annealing and brazing work.

The new Inductron is available in 15, 30 and 50KW capacities . . . each is housed in one complete, compact, self-contained cabinet of the *same* size. The units are wired and equipped to operate on either voltage, 220/440. The machine operates at high frequency (450,000 to 1,000,000 c.p.s.) which makes possible rapid heating, confined to the skin surface for minimum depth of case, narrow transition zone, freedom from scale and minimum distortion.

Many more design advantages—in circuitry and component construction; in controls and instruments—are incorporated. For the complete story on the brand new Inductron, write for your copy of Bulletin No. M-1993. Better still, call in a Process Machinery Division field engineer. Let him brief you on the many Inductron advantages.

CINCINNATI

flamatic and inductron

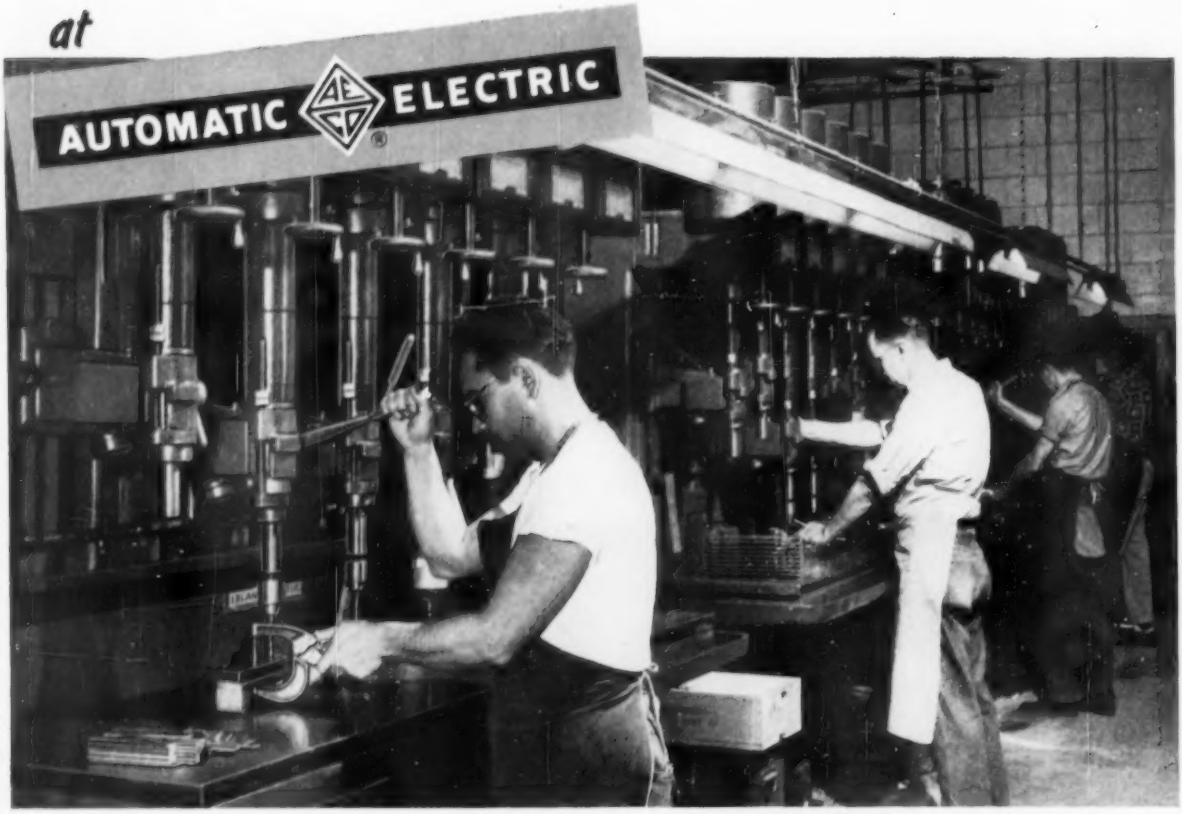
hardening machines

THE PROCESS MACHINERY DIVISION

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

at



This line of LELAND-GIFFORD *Drilling Machines is always busy*

At Automatic Electric Company, leading maker of telephone systems, relays and switch gear, precision drilling is a key production operation.

An infinite variety of large and small parts go into the equipment which they supply to telephone companies. Accuracy in drilling, tapping, reaming and related operations contributes to ease of assembly and faultless performance of equipment which is often complex, always vitally important to good telephone service.

To handle this wide range of drilling operations, and to provide the complete flexibility and fast speed changes necessary to expedite work flow, Automatic Electric Company relies on this battery of Leland-Gifford Multiple Spindle Drilling Machines. Particularly advantageous in handling work of this type are the centralized controls and built-in safeguards against costly errors featured on Leland-Gifford Drilling Machines.

The complete line of Leland-Gifford Drilling Machines offers a wide choice of machine sizes, number of spindles, swings and types of feed. They represent the ultimate development of more than 50 years of specialization in the manufacture of precision drilling equipment. Write for complete information or call the office near you.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

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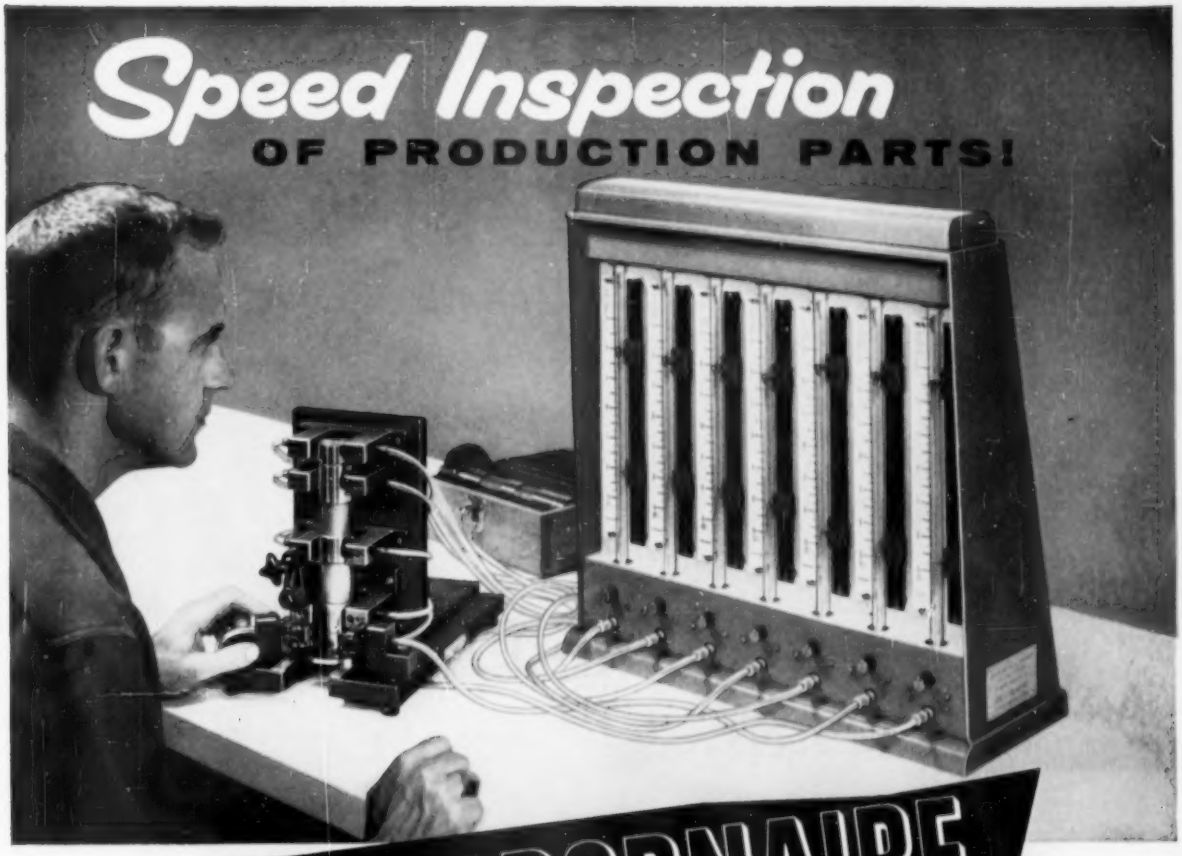
LOS ANGELES OFFICE 2620 Leonis Blvd. Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 13, P. O. Box 24, Charlotte Station

COLLINS



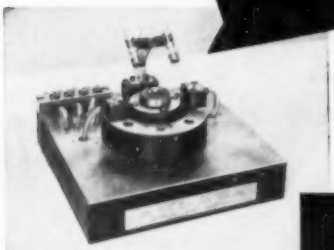
NEW **DEARBORNAIRE**

MULTIPLE COLUMN AIR GAGING INSTRUMENTS

To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

- New higher rated pressure system and built-in circuit restrictions make them virtually self-cleaning, reduce maintenance to a minimum.
- New glass tube has a characterized internal taper which provides positive linear accuracy over the full extent of the calibrated scales.
- Easy-to-read Zero-centered scales permit use of instrument for normal inspection, statistical quality control, and as a tool setting gage.
- Interchangeability of component parts simplifies conversion from one amplification to another, reduces spare parts inventory costs.

Plus a complete line of air gage spindles, rings, snaps and cartridges all precision finished to give you greater accuracy, longer wear life. Free demonstration arranged upon request. Write for details today!



Special Air Gaging Fixtures designed and built to meet your particular application requirements. Complete engineering service available upon request.

Send part print showing all dimensions to be checked and tolerances required for prompt quotation and delivery.

AIR GAGE DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

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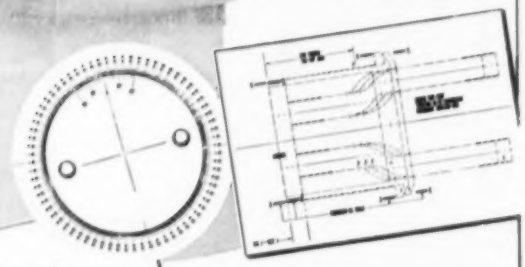
FOR ANY MAKE OPTICAL COMPARATOR

Comparator charts are available in a great variety of stock plastic templates for threads, radii, grid, angles, etc. at low cost.

Special charts can be developed from your blue prints to special specifications and at close limits to suit any type of projector.



Request Stock Chart Catalog No. 56 or submit prints for special proposal.

OPTO-METRIC TOOLS, INC.
137-TE VARICK STREET, NEW YORK 13, N. Y.

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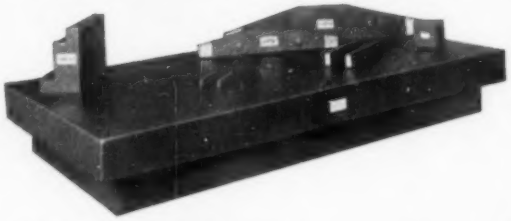

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Gear Driven Eccentric Type Adjustable Drillhead . . . Enclosed, Full Ball Bearing Construction. Double Eccentric Type Adjustable Drillhead illustrated.

- We stock or can build the right drillhead for your jobs.
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Makers of
DORMAN AUTOMATIC
REVERSE TAPPERS

Special Fixed Center Drillhead . . . Made to your requirements. Full Ball Bearing Construction.

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Products Corporation
A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

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AUTOMATION COMPONENTS

Automation fixture to pre-heat, solder and air cool neck on gas tank.

Ready, at a moments notice, to step into the breach in constructing identical components to any engineering requirements:

- ✓ Economically
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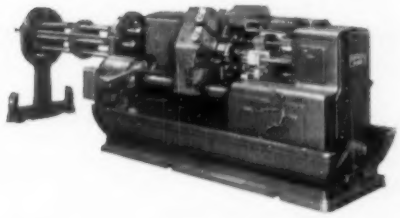
FROM DIESEL ENGINE TO ICE-CREAM FREEZER PARTS

AUTOMATIC BAR MACHINES

Handle All Types of Jobs



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

✓ *Efficiently...*
✓ *Economically*

Greenlee design permits the handling of a wide variety of operations at various spindle positions . . . makes it easier to split up long operations . . . reduces idling time.

Threading, tapping and reaming can be performed in 3rd, 4th, 5th and 6th positions . . . a special Greenlee advantage. Seven full-length T-slots on the main tool slide will accommodate the tools and attachments needed for a wide range of set-ups. Interchangeable cross-slide tooling and simplified cross-slide camming contribute to greater flexibility and faster set-ups.

Investigate! Ask any owner or operator . . . they'll tell you that Greenlee is one of the most highly respected names in its field.

Write for Catalog No. A-405

GREENLEE BROS. & CO.

1986 MASON AVE.
ROCKFORD, ILL.

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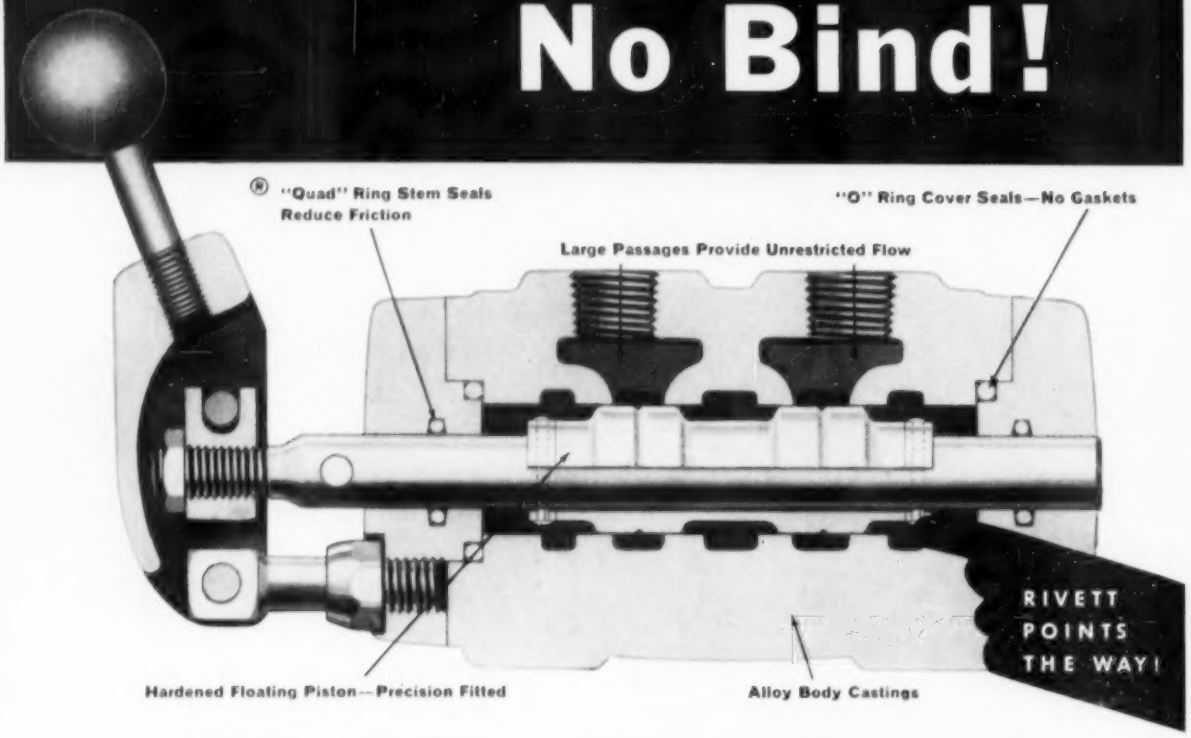
No Stick! No Bind!


® "Quad" Ring Stem Seals Reduce Friction
"O" Ring Cover Seals—No Gaskets
Large Passages Provide Unrestricted Flow
RIVETT POINTS THE WAY!
Hardened Floating Piston—Precision Fitted
Alloy Body Castings

—with Floating Piston!

Valve Stem is Independent of Valve Bore
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Other Fine Features Benefiting Your Circuit Design and Operation

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- Large Passages Provide Smooth, Full Capacity Flow
- Simple Design Assures Leakproof Operation
- Opens And Closes Smoothly, Positively
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1607 VALVE SELECTIONS!

Types: Hand, foot, cam, solenoid, pilot, oil pressure, air pressure, flow control, check, deceleration, relief, unloading, sequence, counterbalance.

Sizes: ¼", ⅜", ½", ¾", 1", 1¼", 1½".

Actions: Standard, spring-return, spring-centered, ball detent.

Mountings: Pipe mounted; panel mounted.

P.S.I.: 1500 P.S.I.; 3000 P.S.I. oil service.

Piston designs for any circuit.

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Brighton 35, Boston, Mass.

THE BETTER YOU KNOW HYDRAULICS THE BETTER YOU LIKE

Get Catalog No. 204 to aid your circuit design. Complete drawings, specifications, cut-away views, tables, diagrams!

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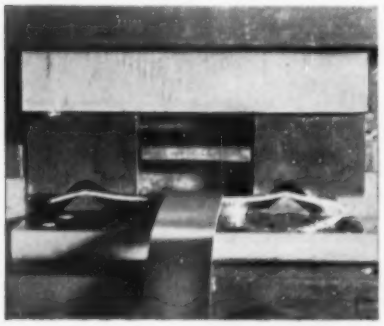
RIVETT
"100"
HYDRAULIC VALVES

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Maker of Beer-Can Openers Likes Economy of Lehigh H

Cadet Manufacturing Corp., San Antonio, Texas, needed a strong, long-wearing die for the economical manufacture of beer-can openers. They put the problem up to their local tool-steel distributor, Earle M. Jorgensen Co., who recommended Bethlehem Lehigh H. "Our experience with this air-hardening grade has shown us how it stands up," the Jorgensen people said. "It's resistant to wear and, besides, has low distortion in heat-treatment."



The die was produced by Precision Manufacturing Co., San Antonio, and heat-treated by Cook Heat Treating, Houston. It was placed in service in a 56-ton press in Cadet's shop, where it was fed C 1035 cold-rolled strip, 0.065 in. thick. Performance was excellent, the die performing economically at the high speed at which the press operated. About 800,000 pieces were produced between grinds.

Lehigh H, our high-carbon, high-chromium grade of air-hardening tool steel, is ideal for tough assignments because of its outstanding wear-resistance and toughness. It is well known for its minimum distortion in heat-treatment, and high compressive strength.

TYPICAL ANALYSIS

Carbon 1.55	Molybdenum 0.80
Chromium 11.50	Vanadium 0.40

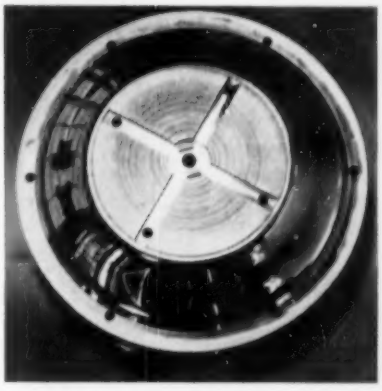
Look into the advantages of Lehigh H by giving it a try. Chances are good that your local Bethlehem tool steel distributor has Lehigh H in stock. Give him a call.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Follow Up With Temper When Drilling Hardened Tools

When necessary to drill holes in hardened tools or dies to incorporate dimensional changes, such drilling is usually done with a triangular drill made of a cast stellite or a sintered carbide. This type of drill operates by generating frictional heat sufficient to locally anneal the steel, so that the cutting edges can scrape the metal away in the path of the drill. All tool steel grades, regardless of how high the hardness developed by heat-treatment, can be drilled in this manner.

It is obvious that such a procedure will produce stresses in tools or dies which, because of heat-treatment, already contain residual stresses. It is important, therefore, that the drilling operation on hardened tools always be followed by a tempering operation. Tempering should be carried out at a temperature equal to, or slightly below, the final temper used in the original heat-treatment operations.

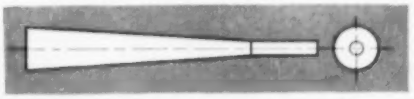


Lustre-Die Provides High Sheen When Making Plastic Parts

This core for a plastic injection mold, made by Interstate Mold & Hobbing Co., Union, N. J., is for use in manufacturing a decorative bowl for household use. It is made of Lustre-Die, an electric-furnace steel of well-balanced analysis, which we alloy-fortify to increase its depth of hardenability and mechanical properties. Use Lustre-Die when you want unusually high sheen on plastic parts. You'll like it.

How much are you paying for the machine that isn't there?*

Because a Torrington Rotary Swaging Machine shapes work by reduction instead of cutting metal away, you can often save on both material and time by swaging parts you are now machining.



This part, for example, was formerly turned from brass bar stock. When swaged from tubing, stock weight was reduced 83%, and the work cycle cut from 86 seconds to 12 seconds!

You can put many operations on a Torrington Swager—pointing, tapering, reducing, sizing, forming inside contours and threads. With sizable savings on operations like these, your swaging machine will pay for itself in a short time.

See for yourself what swaging is and what it can do. Let us show you our new, 20-minute, full-color film on swaging. And write for our catalog on Torrington Rotary Swaging Machines.

THE TORRINGTON COMPANY • Swaging Machine Division
444 North Street, Torrington, Conn.

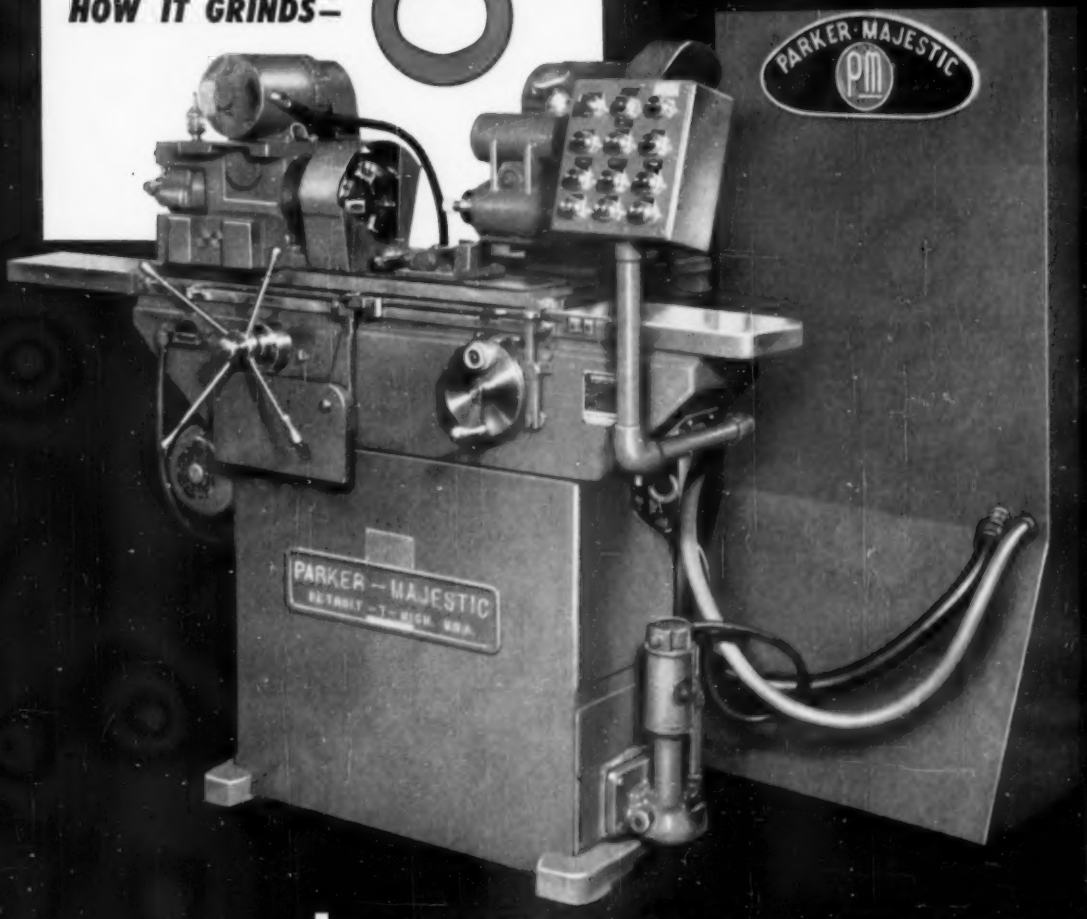
TORRINGTON ROTARY SWAGING MACHINES

Parker Majestic

OFFERS NEW ECONOMY IN CONTOUR GRINDERS

The Semi-Automatic Internal Contour Grinder

SEE
HOW IT GRINDS—



FEATURING

1. Extreme repetitive accuracy by means of automatic size control.
2. Flexibility of application.
3. Modest tool cost for change-over to different parts.
4. Minimum set-up time required for change-over.
5. Accurate duplication of required cam form.
6. Minimum capital outlay required.

PARKER • MAJESTIC PM PRECISION MACHINES

PARKER MAJESTIC, INC. DETROIT 7, MICHIGAN

Pangborn Hydro-Finish cut cleaning time 50% in this plant

Paid for itself in only six months

Pangborn Hydro-Finish really paid off for this leading glass manufacturer. Cleaning quality increased moldlife 10% to 15% and total cleaning and polishing time was cut in half! The resultant savings paid for the machine in six months and represented a substantial weekly sum thereafter.

Today, through new design and use of air jet sluriators, Pangborn Hydro-Finish costs less originally, costs less to maintain and gives you easier handling and added efficiency. Write for Bulletin **1403** to PANGBORN CORP., **4700** Pangborn Blvd., Hagerstown, Md.

USE PANGBORN HYDRO-FINISH FOR:

Deburring • Surface finishing • Finishing threaded sections • Improving cutting tool life • Maintaining dies and molds • Removing grinding lines • Removing heat treat scale • Preparing surfaces

Pangborn

BLAST CLEANS CHEAPER

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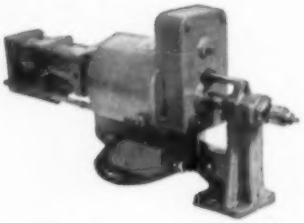
AUTOMATIC DRILL UNITS *for AUTOMATION*



MODEL 111—3/32" CAPACITY	MODEL 113—¼" CAPACITY	MODEL 603—½" CAPACITY
1000 to 10000 RPM or 2500 to 15000 RPM CONTINUOUSLY VARIABLE SPEED CONTROL	15 SPEEDS 750 TO 15,800 RPM	600 to 4000 RPM WITH VARIABLE SHEAVES

ELECTRIC MOTOR SPINDLE - AIR HYDRAULIC FEED

Write for More Descriptive Bulletin

The ELECTRO-MECHANO CO.

175 E. Erie St. Milwaukee 2, Wis.

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APEX TOOLS

INSERTED-BLADE MILLING CUTTERS AND SINGLE-POINT TOOLS FOR ALL METAL-CUTTING NEEDS

"Apex" inserted-blade milling cutters incorporate the adjustability and economy necessary in these tense times when fast quality production is a "must".

The famous "Apex Shankless, Adjustable, Serrated design offers you holders for every metal removing job. Forty tool bits to choose from, all interchangeable without regrinds. "Apex" bits fit holders of other make. Check with us on this. Carbide tips if desired. Send for catalog.

APEX TOOL & CUTTER CO., INC.
SHELTON 16, CONNECTICUT

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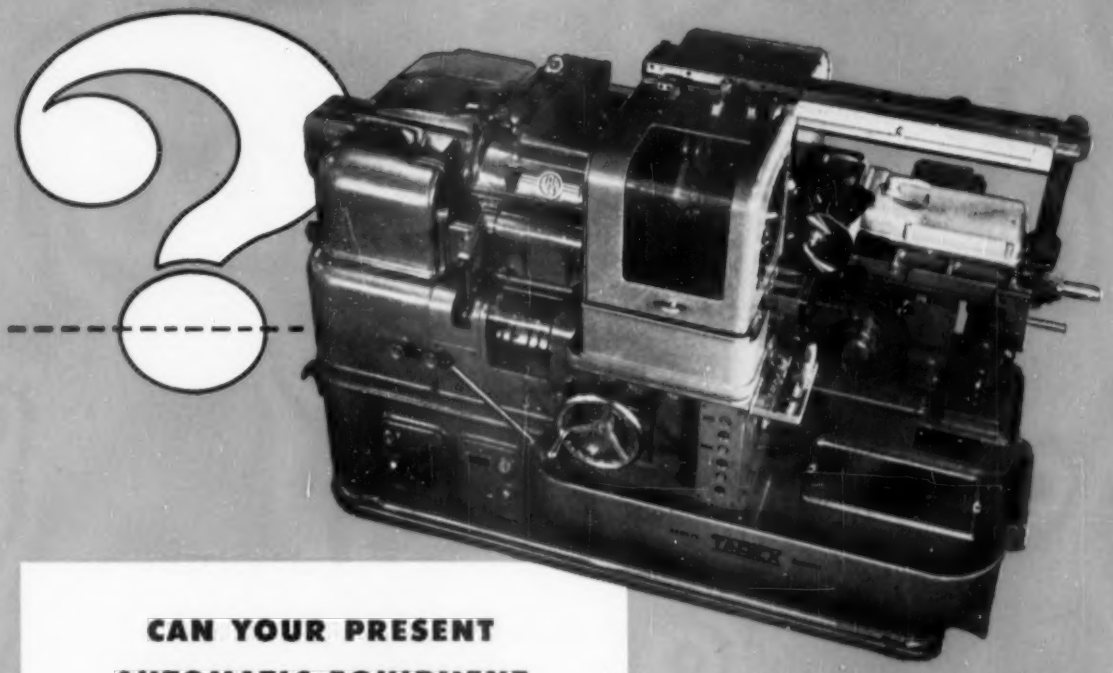
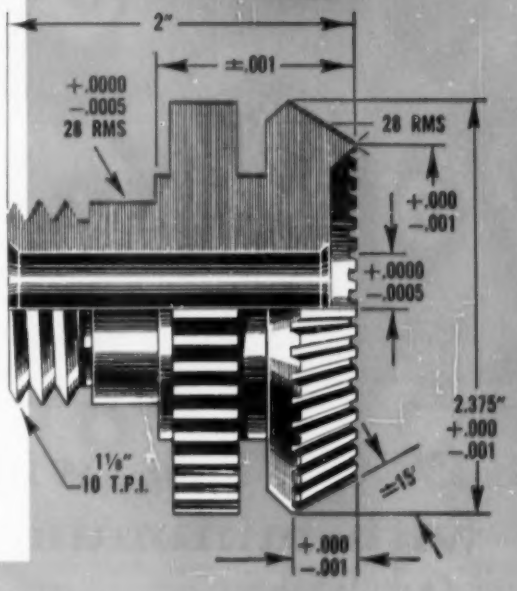


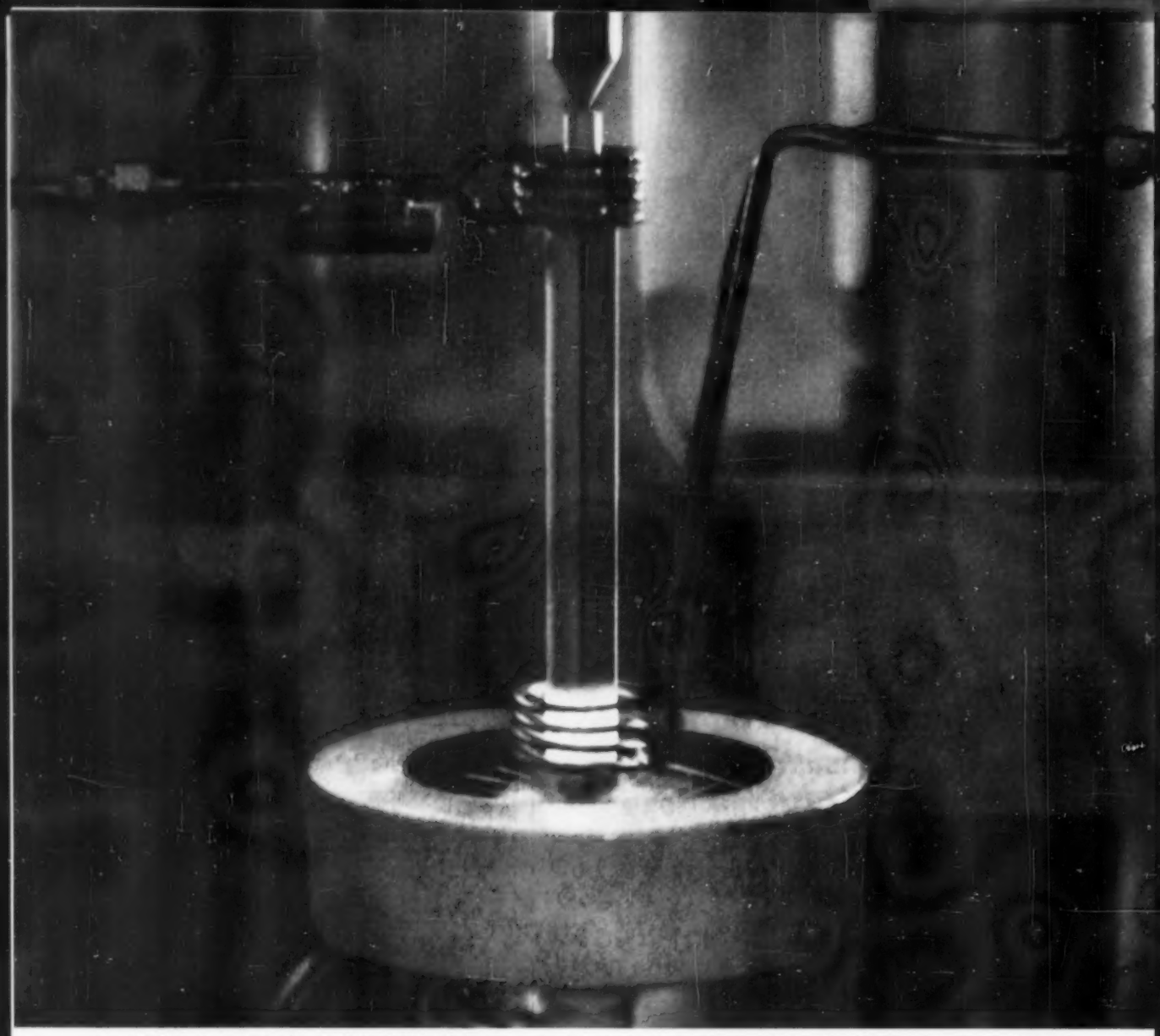
CAN YOUR PRESENT AUTOMATIC EQUIPMENT *make this* **BEVEL CLUSTER GEAR** *complete* **FROM BAR STOCK** *in one operation* **READY FOR GEAR CUTTING?** *...it can be done on the*

TAREX



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



Ketos shaft being induction hardened to Rockwell 55-56, while ends remain soft for final machining. Photographed at Control Instrument Co., Inc., Brooklyn, N. Y.

KETOS has wide hardening range with minimum volume change...

Ketos is a low priced alloy tool steel that can be hardened from low temperatures with practically no volume change. It has deep hardening qualities, and a fine grained structure, that make it desirable for many production parts.

That's why nondeforming Ketos is well suited not only for most tool steel applications such as gauges, dies, and taps but also for close-tolerance, wear-resistant parts like the actuator bar shown in the induction heating unit above. The thin contact edges of this particular part withstood a "life test" of over 4-million high speed blows. No other steel tested lasted more than 1-million cycles before it chipped and failed.

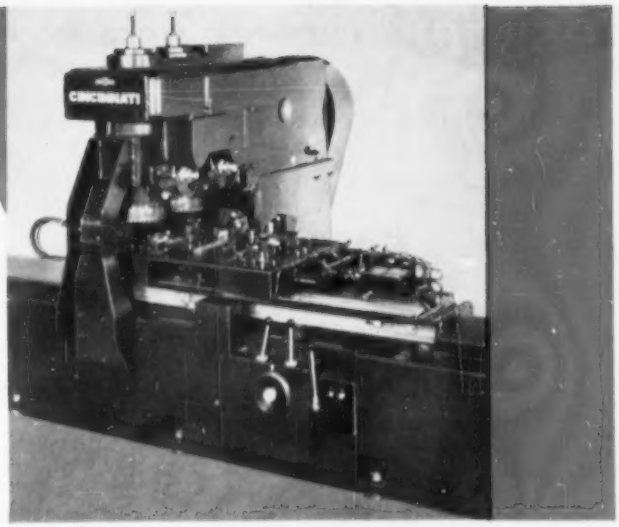
If Ketos sounds like the steel you should be using, call your nearby Crucible warehouse. Stocks of Ketos and dozens of other special tool steels are large, delivery fast. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

Easy on your Replacement Fund---



HyPowermatic with 50 hp main drive and two vertical spindles in a fixed housing, tooled up to mill the top and combustion face on cylinder heads. Many standard HyPowermatic units and features are incorporated in this machine.

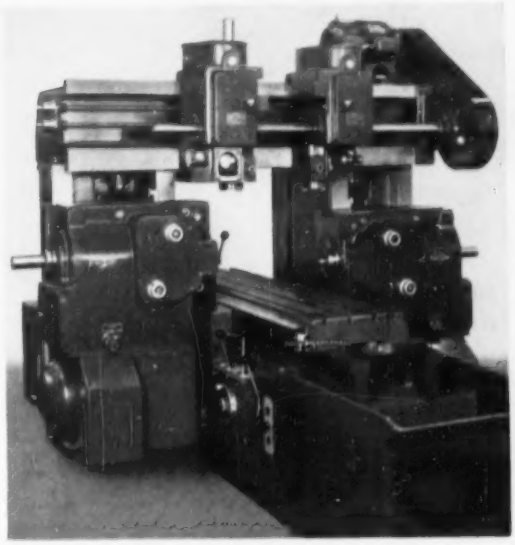
Cincinnati HyPowermatic Unit Construction Plan

Don't discard new production milling ideas as being too costly without considering Cincinnati's HyPowermatic unit construction plan. You may find that a special machine is entirely unnecessary. HyPowermatics are assembled from standard and complementary units to give you unusual combinations such as:

1) Close-coupled spindle carriers
2) Vertical and angular spindle heads; many styles and combinations, including adjustable angle
3) Ram mounted spindle heads
4) Fixed height or adjustable bridge type rail support for vertical spindle heads

Take a look at the heavy duty automatic milling machines in your shop which may have become productively obsolete. You may be surprised to see how much you can gain—in production and lower unit cost—by replacing with CINCINNATI® HyPowermatics, built up with standard and complementary units to suit the job. They offer many cost-cutting replacement possibilities. May we send you a copy of the new, fully illustrated catalog? For brief specs, look in Sweet's.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



HyPowermatic, duplex style, equipped with highly useful complementary units consisting of two additional spindle heads mounted vertically on a cross rail. This HyPowermatic can mill simultaneously the sides and top of box-shaped parts.

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS
METAL FORMING MACHINES • HARDENING MACHINES • OPTICAL PROJECTION
PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

OSBORN BRUSHING METHODS *worthy of your confidence*

6-second finish

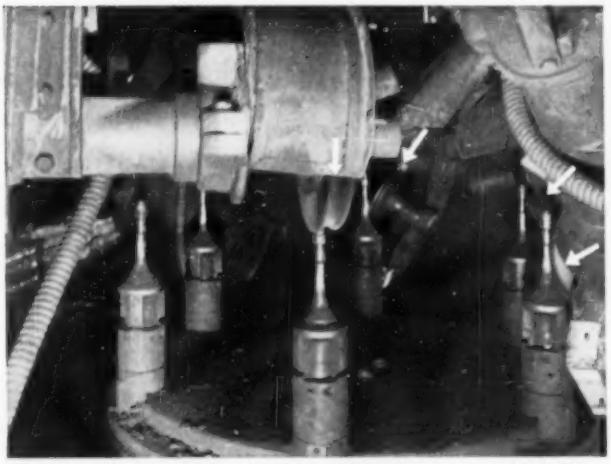
BEFORE BRUSHING

AFTER BRUSHING

THE efficient job performance demanded of these cylindrical steel cams requires the proper finishing of their many surfaces. Power brushing proved to be the most effective method for removing the sharp edges and small burrs.

In the operation shown below, Osborn Power Brushes mounted on an automatic rotary machine remove minute burrs and blend surface junctures. This is done on a 6-second cycle . . . quickly, accurately and economically.

An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, may point the way for improvements in your operations. Write *The Osborn Manufacturing Company, Dept. K-35, Cleveland 14, Ohio.*

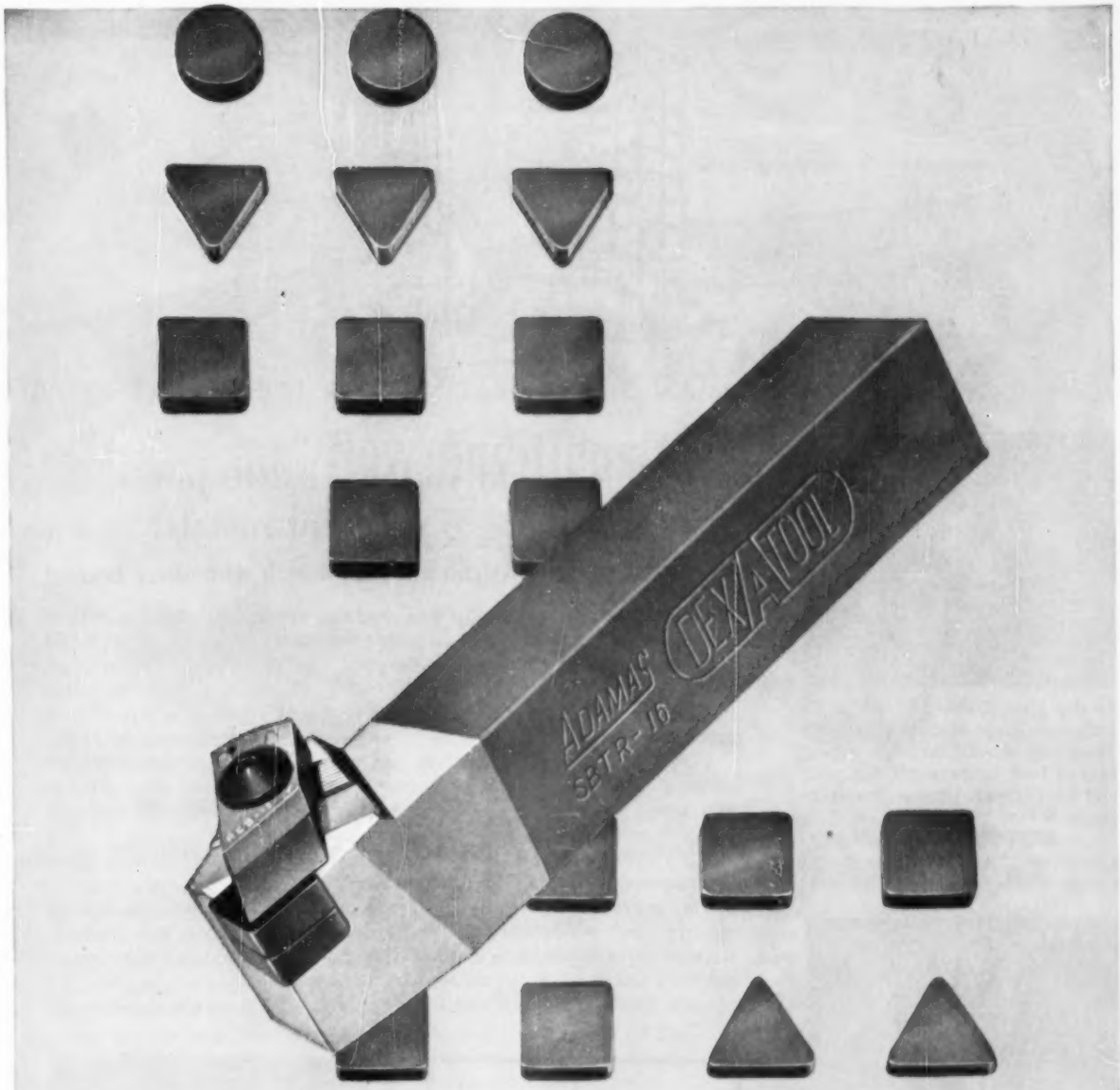


Four Osborn Monitor® Brushes remove burrs and produce accurately finished parts.

Write TODAY for the new 100-page Osborn Catalog 210-C

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

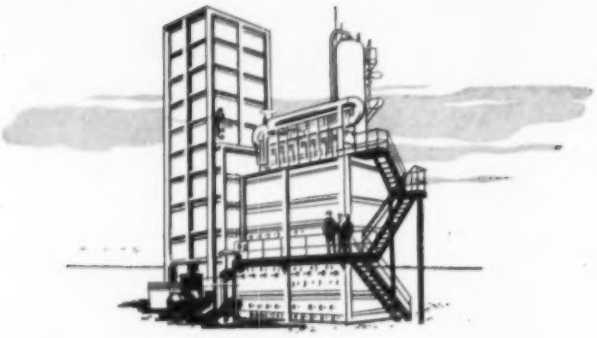


4 WAYS BETTER

- Fully adjustable chipbreaker
- Invertible and indexable carbide or steel anvils
- Holds both 3/16" "thick" inserts and 1/8" "thin" inserts
- Choice of standard or setscrew chipbreaker clamps

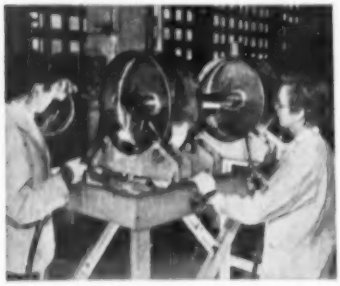
ADAMAS CARBIDE CORPORATION, KENILWORTH, N. J.

PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL AND CERALOX.



JOIN WITH HANDY & HARMAN SILVER BRAZING FOR PERMANENT PROFIT

Joining Heat-Exchanger Tubing To a Header Ring: Brazing team joins 78 closely spaced tubes to header ring of heat exchanger. Degreasing and fluxing with Handy Flux takes place before assembly. EASY-FLO 35 is hand-fed; heating is oxy-acetylene. Two operators braze complete assembly in 35 minutes.



Brazing Tube Sheet Into Sleeve: Involves a hermetic joint between ¾ in. thick copper tube sheet and the inside wall of a copper-bronze sleeve. Operators work as a team, one face-feeding the EASY-FLO 35 wire from the front, partner heats from the back to draw molten alloy through. On some units joint is 1½ in. thick, 170 in. in circumference. Average time 30 minutes per joint.

How would *you* make 300 joints involving 6 different metals?

Air Products, Inc., Allentown, Pa., does it with silver brazing

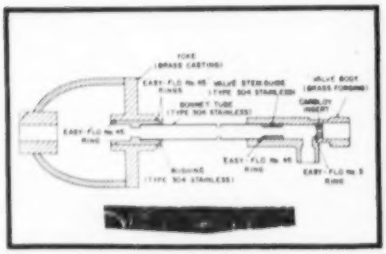
Here you have an air separator that produces tonnage quantities of oxygen and/or nitrogen for industrial uses. Its components are made of Type 304 stainless steel, cast bronze, brass, copper, copper bronze and Carboloy. Joints range in size from less than ¼ inch to 54 inches in diameter. Metal thicknesses vary from .025 to 1½ inch. In operation, the separator is exposed to temperatures of –300°F and pressures approaching 5000 psi.

Complex? You said it and when you take *everything* into consideration – range of metals, operating strength, metal thickness, joint sizes, production speed and economy – Handy & Harman silver alloy brazing is the *best* way to do it.

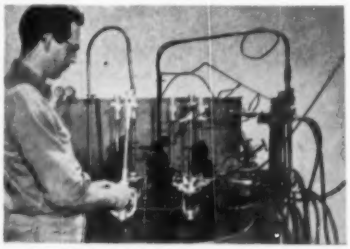
Air Products handles these multiple production problems with speed and dispatch. Illustrated are three examples.

This operation typifies the versatility of Handy & Harman silver alloy brazing. Here is one method doing a *wide variety of jobs.* It is doubtful whether any other existing method could be used to the same effect on an *assembly line basis.* It can do as much for you.

Look into Handy & Harman silver brazing. We'll work closely with you.



Six-Piece Expansion Valve Assembly Joined In One Operation: Drawing of valve assembly shows locations of 5 preplaced rings of EASY-FLO 3 and EASY-FLO 45. Rotary table silver brazes about 20 expansion valves an hour, more than three times the former rate with hand torches. Multiple burners are used to reduce heating time for the heavy brass parts. Burners can be repositioned and more burner stations added.



Bulletin 20, to begin with

This concise bulletin introduces you to silver alloy brazing—gives joining methods and joint design as well as economies that exist with EASY-FLO brazing. Just ask, we'll be pleased to send you a copy.

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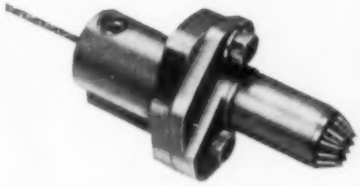
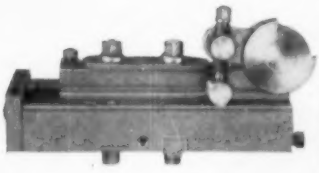
Announcing

New Additions to the RIGHT R and L LEFT Family! . . .



NEW ON AND OFF CENTER DRILLING ATTACHMENTS

This ingenious turret drilling attachment is designed to save you second set-up time. It is no longer necessary to remove the cut-off piece in order to drill an off-center hole in the end of a bar. Merely stop the spindle, bring this tool into the work and continue the operation. The tool will operate within the capacity of the machine. (Available in ⅝", ¾" and 1" diameter shanks.)



NEW TOOL HOLDERS FOR MULTI-SPINDLE AUTOMATICS

This tool holder, made for circular tools, can be used on the front or rear cross-slide of multi-spindle automatics . . . It is made to operate within the capacity of the machine.

NEW TOOL-SLIDE KNURLING TOOL FOR MULTI-SPINDLE AUTOMATICS

This tool can be used in the tool-slide of multi-spindle automatic screw machines or in the turret of turret lathes. The knurls may be adjusted for various diameters by turning them on an eccentric shaft . . . The tool will operate on any diameter within the capacity of the machine. (Another new R and L TOOL is the Cross-Slide Knurling Tool for Multi-Spindle Automatics.)

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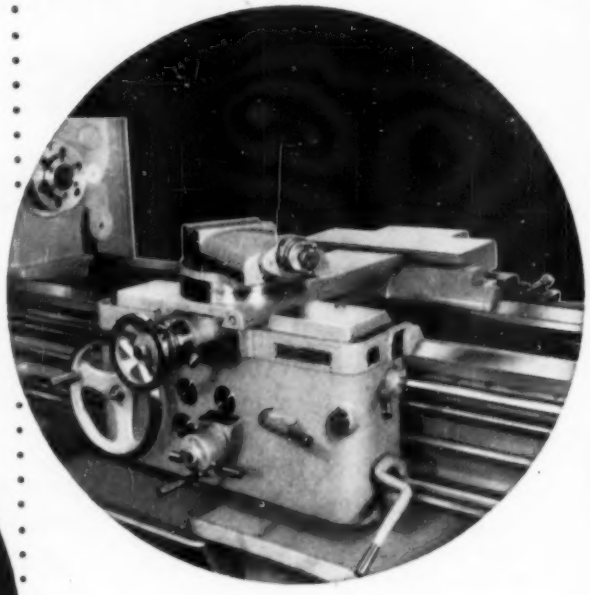

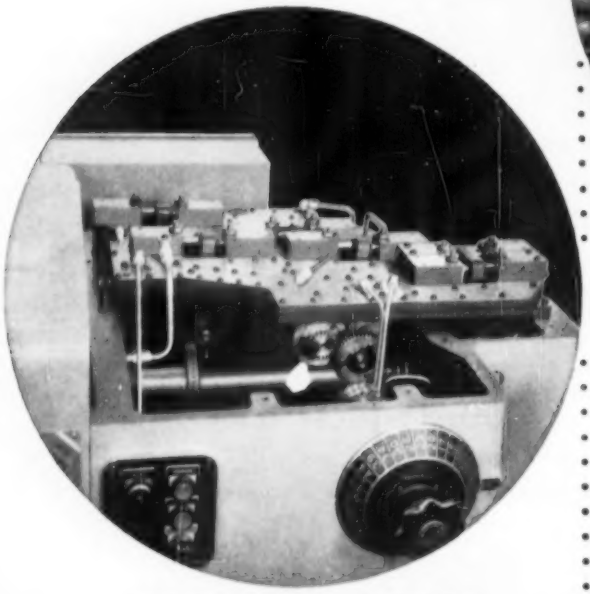

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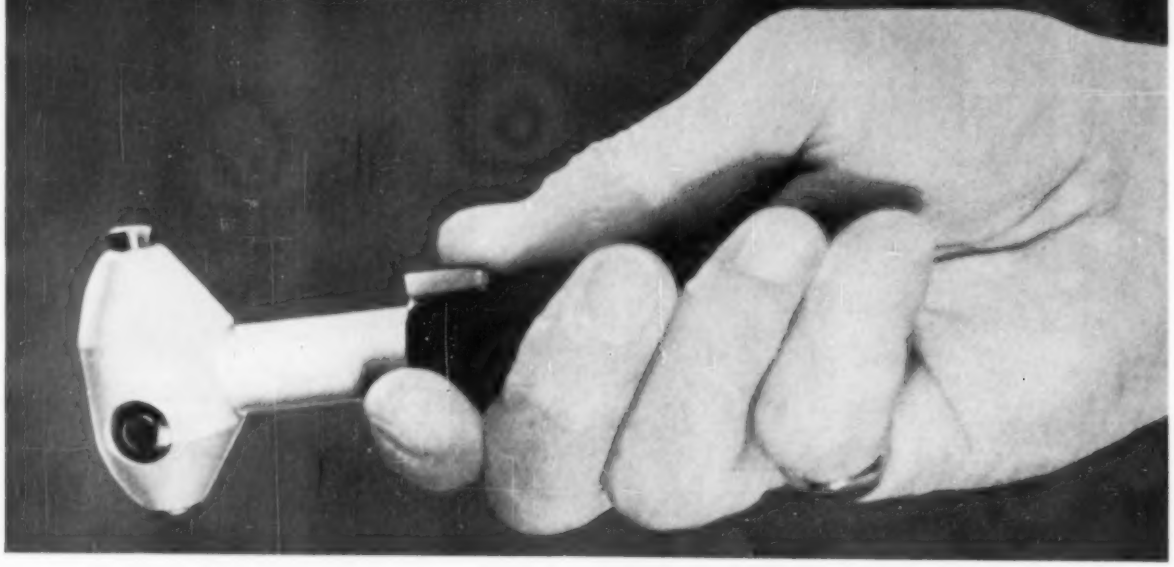

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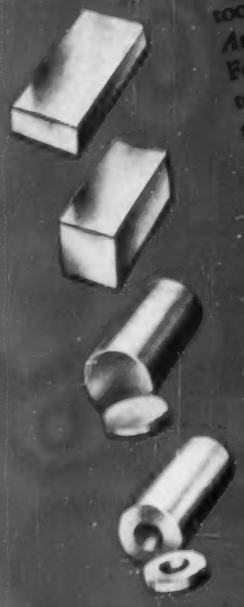

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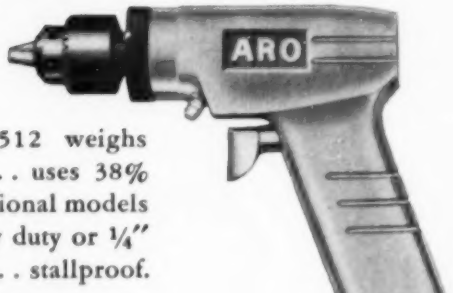

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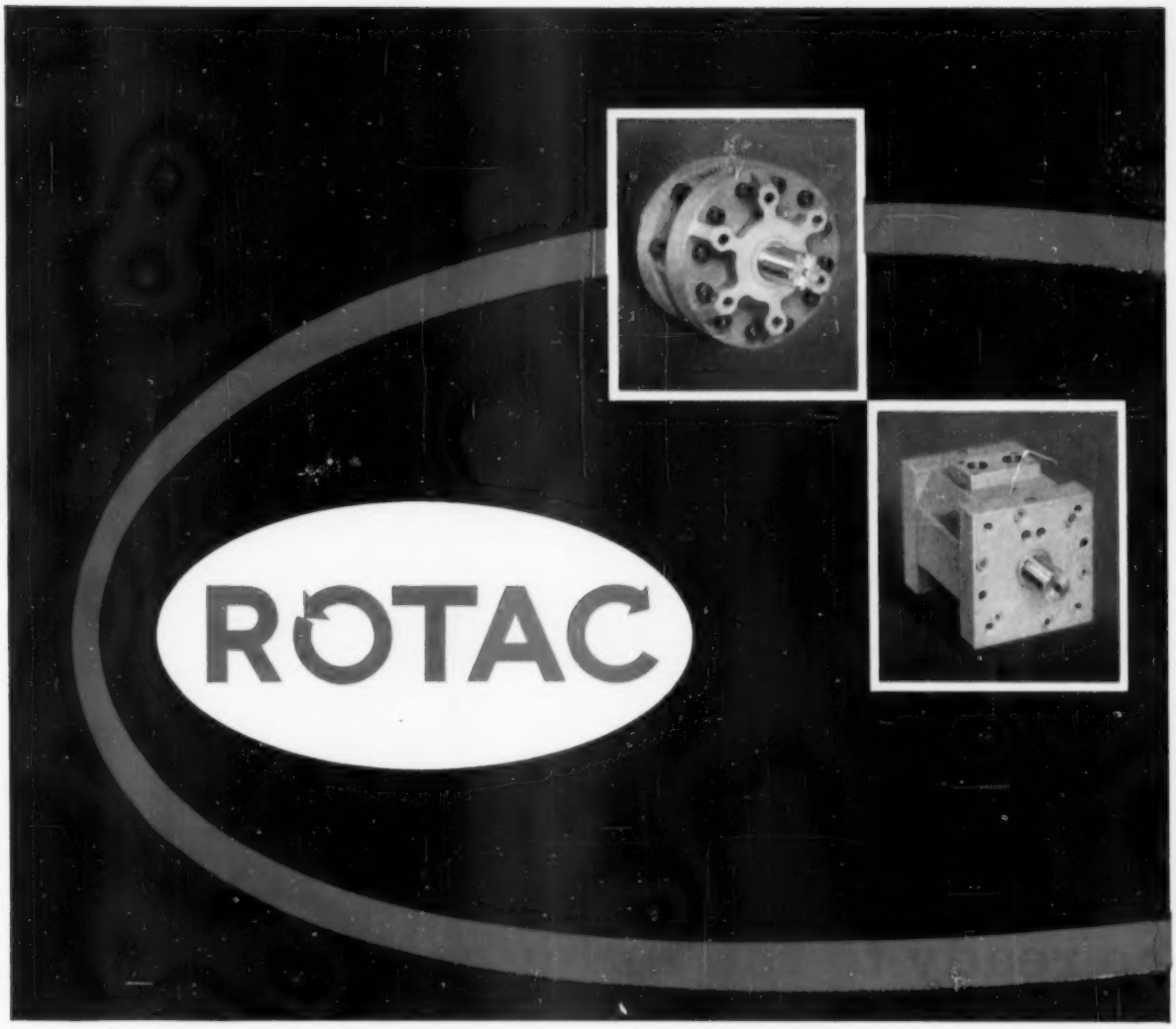

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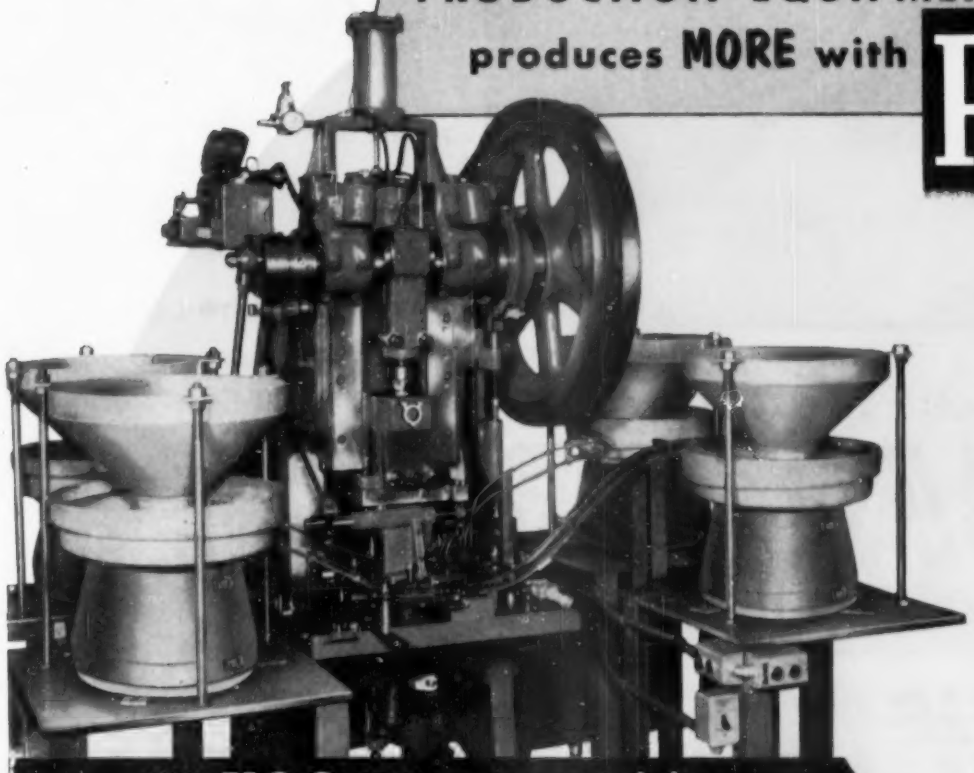

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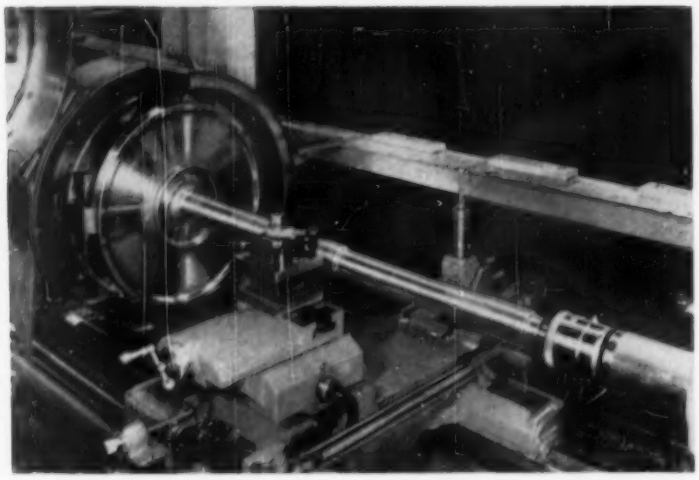

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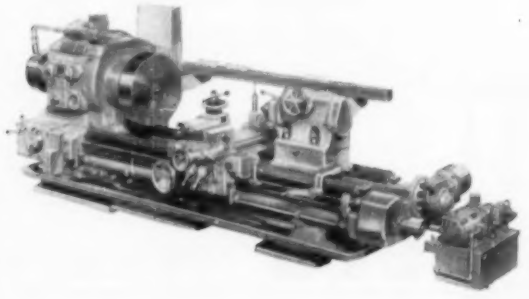

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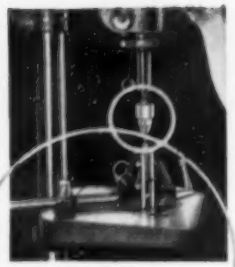

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INCREASE DRILL PRESS PRODUCTION

AMF Wahlstrom Automatic Keyless Chuck: Convert 95% of lost tool-changing time to productive time. A single chuck does the work of several spindles. The greater the load, the tighter the grip. No stopping of the spindle to change tools.

AMF Float-Lock Instant Change Vise: Positive anchoring on drill press table. *Floats and Locks* in any position. Holds work safely for accurate drilling and tapping.

Write for details and name of nearest distributor.

AMF Tool Division

AMERICAN MACHINE & FOUNDRY COMPANY

224 Glenwood Avenue, Bloomfield, N. J.

USE READER SERVICE CARD; INDICATE A-6-298-2

Drill Hardened Steels without Annealing—

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon–high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.

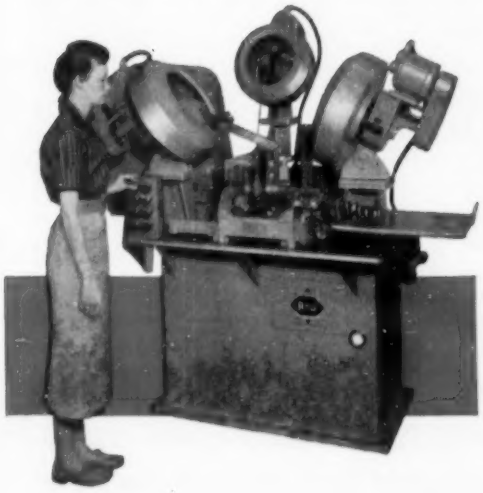
1414 East 222nd St. • Cleveland 17, Ohio

"HARDSTEEL"

USE READER SERVICE CARD; INDICATE A-6-298-3

R-J NEEDLE BEARING ASSEMBLIES

REHNBERG-JACOBSON



NEEDLE BEARING ASSEMBLY MACHINES

PURPOSE: To assemble the "needles" into their cup, bushing, hub, hole, or housing — and to do this *automatically* at high production rates. Also, to add, when required, a shot of grease, a pressed-in retaining cup, a snapped-on rubber grommet, or a dummy plug.

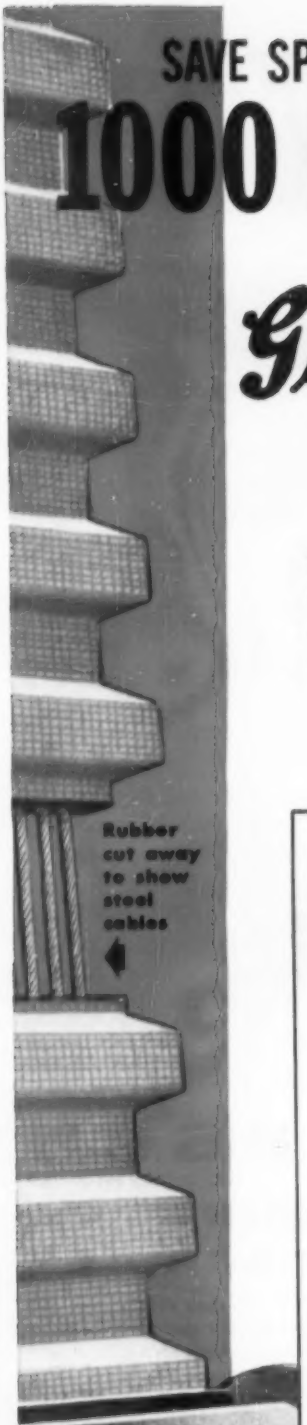
ACCOMPLISHMENT: The desired result, in a vast variety of applications, as shown by just a few examples above. A typical 3-hopper full-automatic machine is shown at the left.

NOTE: For many years we have been outstandingly successful in producing these highly-specialized machines. This is your assurance of satisfying performance.

REHNBERG-JACOBSON MANUFACTURING CO.

2135 KISHWAUKEE ST., ROCKFORD, ILL.

DESIGNING ENGINEERS, MANUFACTURERS, AND PRODUCTION CONSULTANTS



SAVE SPACE AND COSTS...TRANSMIT UP TO *OR OVER*

1000 HP WITH THE NEW

Gilmer XX HEAVY DUTY

1¼" PITCH

"TIMING"® BELT DRIVE

TO HELP YOU COMPARE a Gilmer *XX Heavy Duty* "Timing" Belt drive with the four other common forms of power transmission of equal capacity, a power transmission engineer offers his recommendations based on published application and load ratings, for the following:

A 300-HP drive (at 1160 rpm.) including application factors
3.00: 1 speed reduction
Approximately 50" center distance

Here, complying with minimum pulley sizes and other practices commonly observed, are his recommendations (with approximate comparative cross sections of space occupied by each drive):

"TIMING" BELT DRIVE
Belt: XXH "Timing" Belt 10" wide by 160" P. L.
Motor Pulley: 9.549" P. D. (24-groove) 1¼"-pitch
Driven pulley: 28.648" P. D. (72-groove) 1¼"-pitch
Belt speed: 2900 feet per minute

V-BELT DRIVE
Belts: 10 Super Service "D"-Section V-Belts (DP-225)
Motor pulley: 18.0" P. D. x 10 D-groove, 14¾" wide
Driven pulley: 54.0" P. D. x 10-groove, 14¾" wide
Belt speed: 5380 feet per minute

GEAR DRIVE
Herringbone gear speed reducer with 3:1 ratio. (A typical reducer of required capacity weighs 1440 lb., measures 33" long, 26⅝" high and 19" wide.)

ROLLER CHAIN DRIVE
Chain: #80-8 (8 strands) 1"-pitch x 152 pitches
Motor sprocket: 7.979" P. D. (25 teeth)
Driven sprocket: 23.880" P. D. (75 teeth)
Chain speed: 2380 feet per minute
(Requires Type #3 lubrication with oil-tight case for sump pump)

FLAT BELT DRIVE
Belt: 21" wide x 8-ply x 18' 4" long
Motor pulley: 18" O. D. x 23" wide
Driven pulley: 54" O. D. x 23" wide
Belt speed: 5380 feet per minute

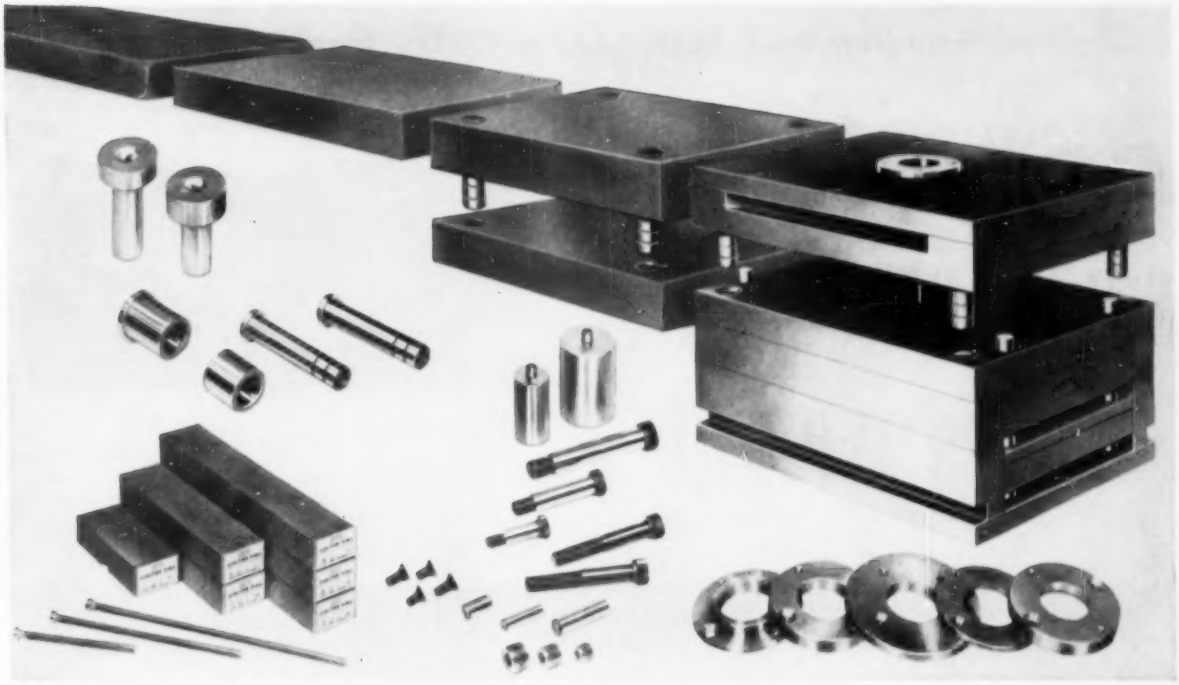
In cost and in weight the "Timing" Belt drive also has a big savings advantage. Ask your NYB&P-Gilmer Distributor for the figures.

NEW YORK BELTING & PACKING CO. Founded 1846

NYB&P

NEW YORK BELTING & PACKING CO. 1 Market St., Passaic, N. J.

America's Oldest Manufacturer of Industrial Rubber Products



PROGRESS IN PLASTICS . . .

. . . and how DME "helped"

The history of economy in modern business has been directly related to the history of Standardization. One of the major elements affecting the economic production of finished plastic parts is the high initial cost of the mold. A progressive step in reducing mold cost, without sacrificing the high quality required, has been successfully achieved through Standardization.

When D-M-E originated Standard Mold Bases and their component parts in 1942, it provided the answer to the rapidly growing demand for high quality molds that would maintain and promote the economic advantages of plastic parts.

Through large volume purchases of quality steel in standard sizes and specialized production facilities, D-M-E was able to produce and supply high quality Standard Mold Bases to mold makers and molders at such great savings in cost and time that the benefits of Standardization were quickly realized by the Industry.

Today D-M-E produces twenty-eight different sizes of Standard Mold Bases, from 9" x 8" to 23¾" x 35½", in either D-M-E No. 1 or No. 2 Steel, with a wide range of cavity plate thicknesses to satisfy the diversified demands required. In addition, over 2,000 finished component parts of the same high quality are available to provide additional savings in service as well as in the product.

Properly engineered Standardization puts the accent on Economy. When you "Specify D-M-E . . ." you get Quality, Service AND Economy!

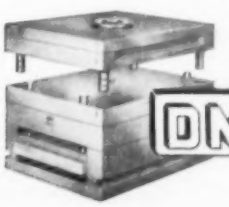
DETROIT MOLD ENGINEERING CO.

6686 E. McNICHOLS ROAD — DETROIT 12, MICHIGAN — TWinbrook 1-1300

Contact Your Nearest Branch FOR FASTER DELIVERIES!

Specify **D-M-E** *for*

QUALITY . . .
SERVICE . . .
ECONOMY !



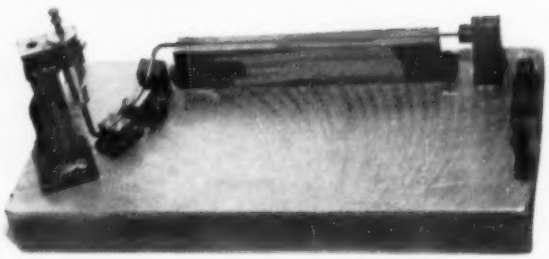
DME

HILLSIDE, N. J. (NEAR NEWARK) 1217 CENTRAL AVE., ELIZABETH 3-5840
CHICAGO 51, ILLINOIS 5901 W. DIVISION STREET, COLUMBUS 1-7855
CLEVELAND 9, O. - D-M-E CORP. 502 BROOKPARK RD., SHADYSIDE 1-9202
LOS ANGELES 7, CAL. 3700 SOUTH MAIN STREET, ADAMS 3-9214

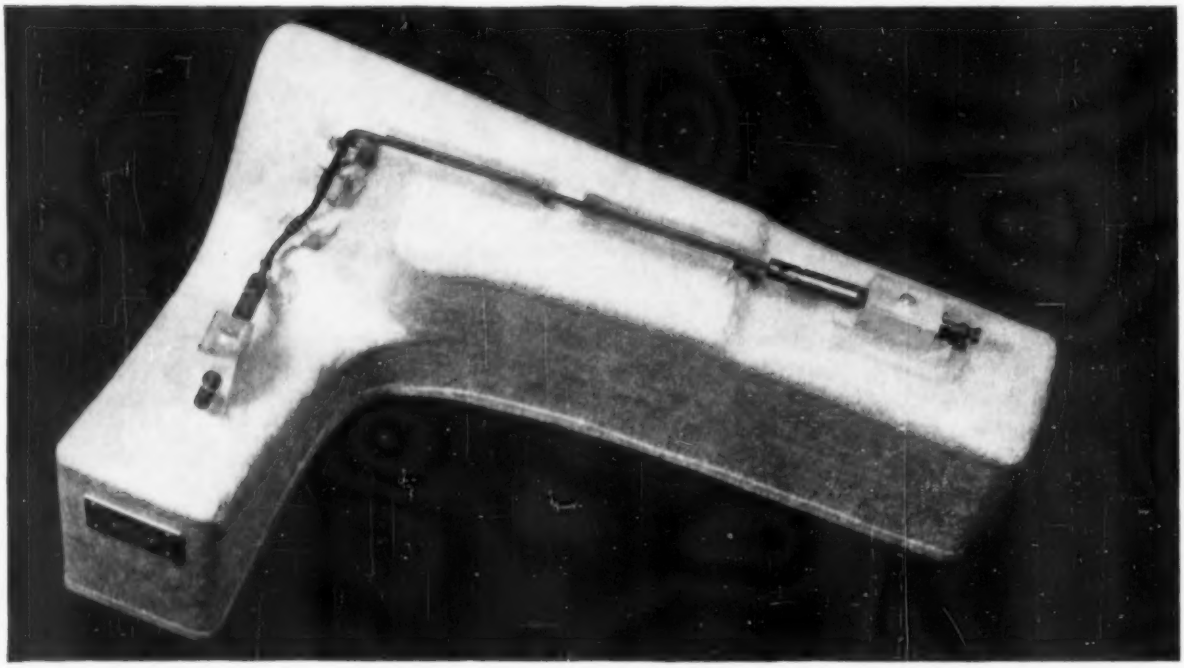
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-6-301

Plastic tooling with BAKELITE Epoxy Resin

saves time, saves machining, saves weight



Checking fixture below is made with tooling compound produced by **Ren Plastics, Inc.,** Lansing, Mich., using BAKELITE Epoxy Resin. Notice its cleaner design and construction compared to older one of steel, above. Both check the same type part. New fixture is lighter, dimensionally stable, quickly produced.



Curves in the tubing of jet engines by Pratt & Whitney Aircraft, East Hartford, Conn., were formerly checked in machined metal fixtures like the one at top.

The new fixture above is a lamination of glass cloth and a tooling compound based on BAKELITE Brand Epoxy Resin. The record shows this method—

SAVES 76 per cent in tool-making time!

SAVES 80 per cent in machining . . . freeing machines for other work!

SAVES 70 per cent in weight . . . making storage and handling simpler!

The plastic tools are dimensionally stable. In fact, their reduced coefficient of expansion disposed of temperature variation problems previously encountered.

Learn how the low cost, efficiency, and convenience of tooling with compounds based on BAKELITE Brand Epoxy Resins can be applied to your operations. Write Dept. XX-00.

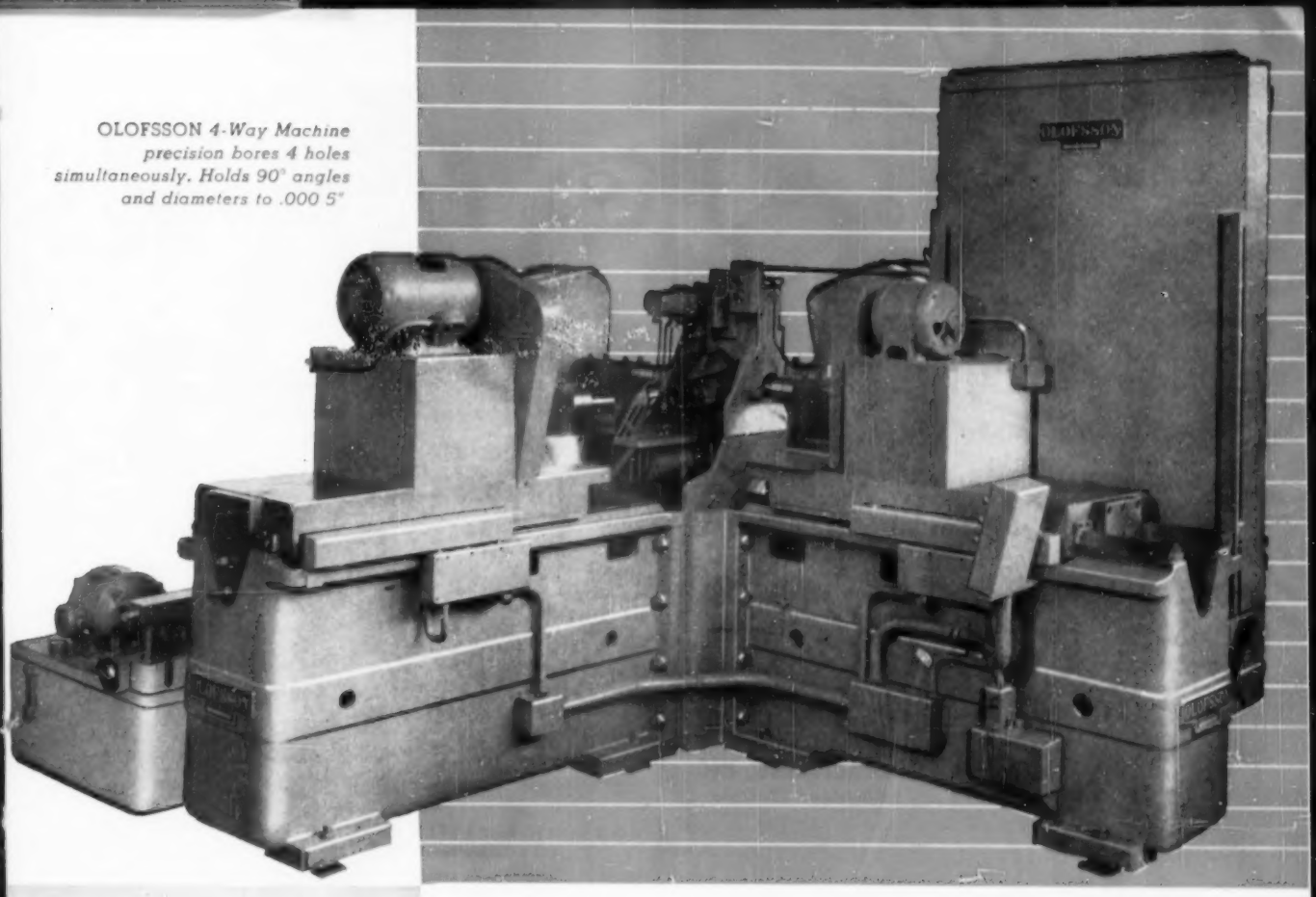
BAKELITE
BRAND
PLASTICS

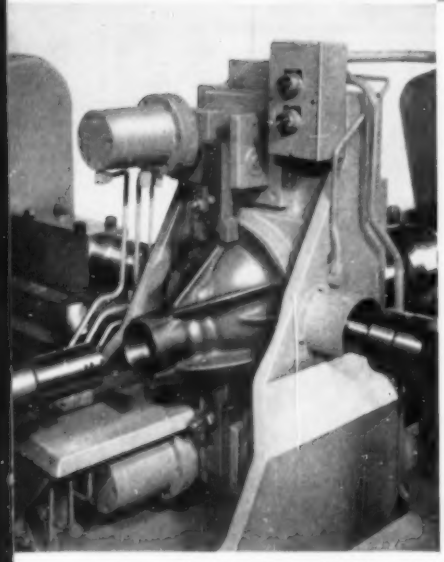
UNION CARBIDE

BAKELITE COMPANY, *Division of Union Carbide Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

The terms BAKELITE, UNION CARBIDE and the Trefoil Symbol are registered trade-marks of UCC.

OLOFSSON *4-Way Machine precision bores 4 holes simultaneously. Holds 90° angles and diameters to .000 5"*





Close-up view of differential carrier, hydraulically cam-clamped in position for boring.

for MORE production and precision, combine 2, 3, or 4 OLOFSSON way units in any COMBINATION

OLOFSSON Precision Way Machines perform fast, accurate boring, facing, turning, grooving, and chamfering. Units are electrically interlocked, and the spindles move to the work.

For long, dependable, and accurate operation Olofsson Way Units feature:

- **Single push-button control panel.**
- **Hardened and ground V-style ways.**
- **Hydraulic control Valves, manifold mounted and located with reservoir.**
- **Parker Majestic precision boring spindle.**
- **Rigid ribbed, nickle iron base.**
- **Adherence to latest J.I.C. recommendations.**
- **Hydraulic pump units located outside base.**
- **Automatic central lubrication system.**
- **Dwell time not affected by positive stop screw adjustment.**

FOR COMPLETE INFORMATION WRITE OLOFSSON CORPORATION OR PHONE LANSING, MICHIGAN, IVANHOE 4-5381.

THE OLOFSSON CORPORATION
2731 Lyons Avenue • LANSING, MICHIGAN

MANUFACTURERS OF PRECISION BORING MACHINES AND SPECIAL MACHINERY

INDUSTRIAL AIR DRILL HAS METERING TRIGGER

Gives positive R.P.M. Control from 0 to 2500

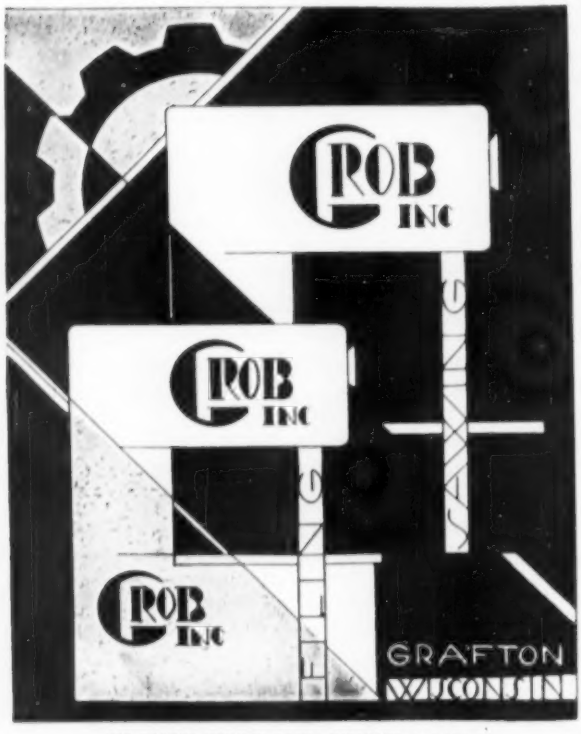
New **SP-1000 Industrial Air Drill** has Superior's exclusive metering trigger — gives positive R. P. M. control from 0 to 2500. The SP-1000 weighs only 2 lbs., has ¼" capacity, a safety chuck shield and ¼ h.p. at 90 P.S.I.

Light weight and easy to use, the drill cuts down operator fatigue — is an excellent production tool for automotive, aircraft, sheet metal and other industrial operations. Nickel steel gears and pre-loaded sealed bearings keep maintenance costs at a minimum. Available with pistol grip, as illustrated, or straight handle.

Write Dept. T-6

SUPERIOR PNEUMATIC & MANUFACTURING, INC.
4758 Warner Rd. **Cleveland 25, Ohio**

USE READER SERVICE CARD; INDICATE A-6-304-1



USE READER SERVICE CARD; INDICATE A-6-304-2

THIS **REVERSE** STAMP

IS A FORWARD STEP!

Hoggson Brand Reverse Stamps are designed for stamping molds for making rubber, plastic and glass products and for marking die sinking molds and forming dies.

Made of high alloy steel, specially heat treated to withstand continuous impact, they are made for marking flat or contoured surfaces, and are GUARANTEED ACCURATE.

Available from stock in letters and figures from 1/16" to 3/8", Hoggson Brand Reverse Stamps are also supplied, hand cut to your order, as symbols, trademarks, or other special designs.

Specify *Hoggson* Brand Reverse Stamps. They're a step in the right direction!

HOGGSON & PETTIS MANUFACTURING CO.
144 Brewery Street **New Haven 7, Conn.**

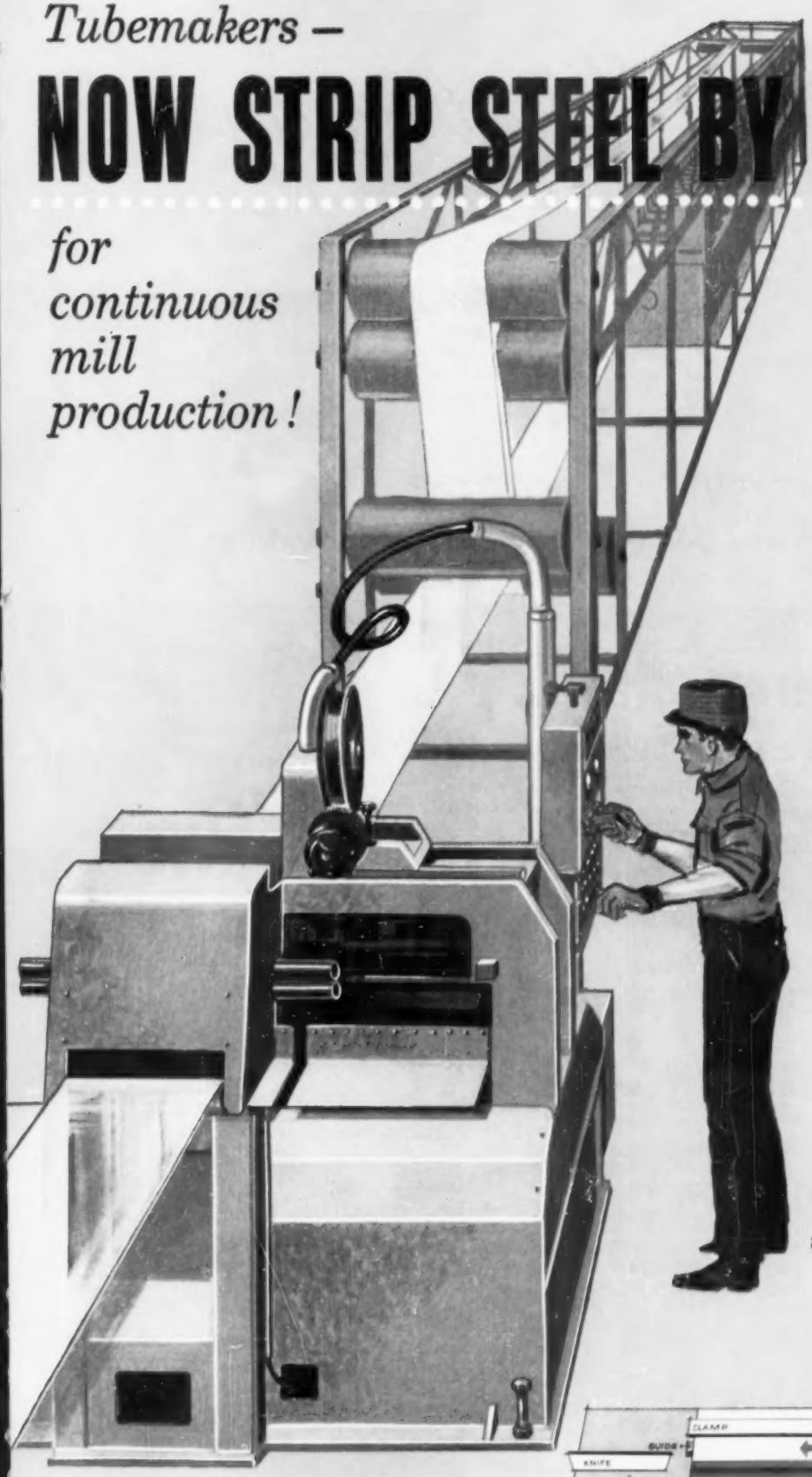
USE READER SERVICE CARD; INDICATE A-6-304-3

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 169.

Tubemakers –

NOW STRIP STEEL BY THE MILE

for continuous mill production!

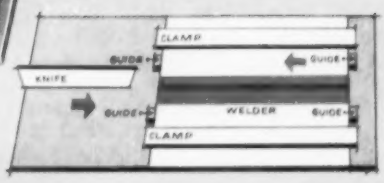


The "MPM SHEAR WELDER" is "a natural" for increasing output and reducing coil end scrap loss.

Perfect welds are a result of positive guiding and clamping, right at the weld area. *(See diagram below.)* Both shearing and welding are done at the same station.

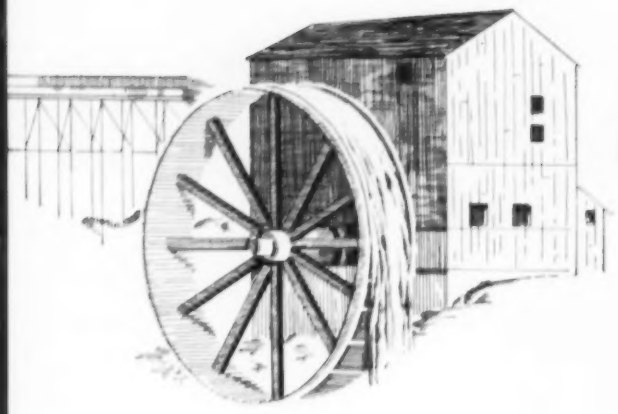
The "MPM" is the fastest, most accurate and compact machine of its kind, that's why tubing manufacturers prefer them over any other type. They are available in a complete range of sizes for any tube mill application. Other types are available for joining strip or sheets of any metal.

Metal Processing Machine Co.
Subsidiary of The McKay Machine Co.
YOUNGSTOWN, OHIO

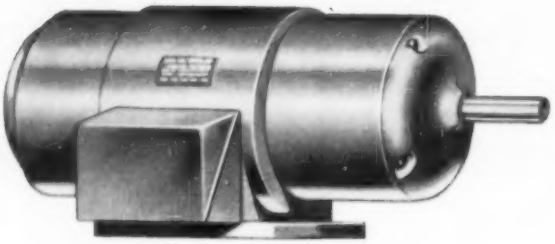


McK
MPM

10092



Great in its day...



BUT

WOULDN'T YOU

RATHER HAVE THE LATEST TECHNICAL ADVANCE?

Now . . . from Heller

Another great technical advance in tools . . .

"Job Tempered" Metal Cutting Band Saws

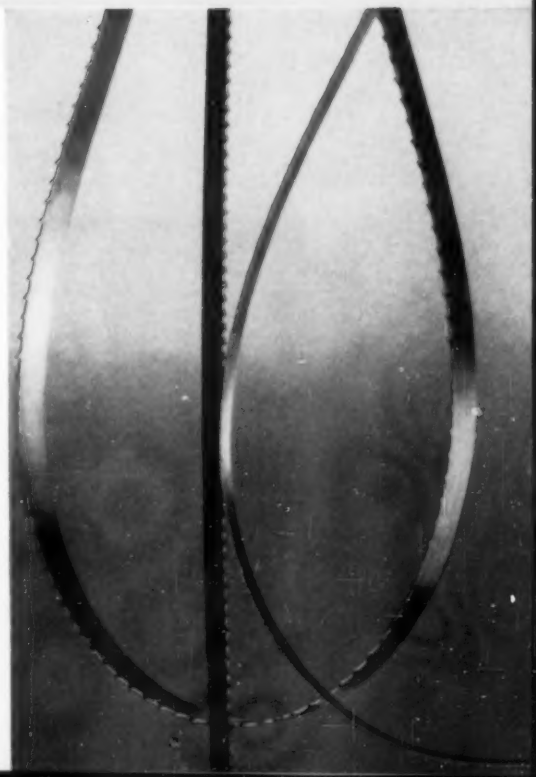
Certified by American Standards Testing Bureau to meet their standards for superior cutting — Uniform Teeth . . . Uniform Set . . . Uniform Temper*

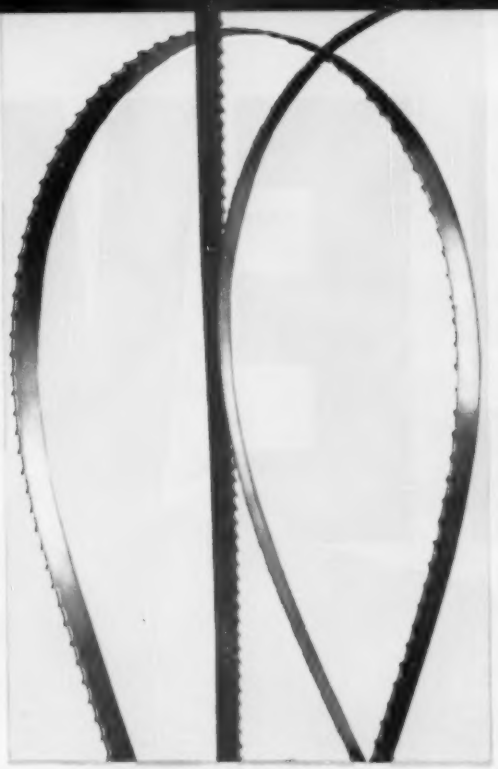
There's a new way to achieve smoother, faster cutting on band saw machines, with longer life on a variety of metals. Heller's "JOB TEMPERED" Metal Cutting Band Saws.

Heller's exclusive metallurgical and heat treating processes that have won these blades the name "JOB TEMPERED" have also earned them American Standards Testing Bureau's Certification. This is your assurance that these blades meet the three prescribed standards for superior cutting . . . uniform teeth . . . uniform set . . . uniform temper. As a result, when you use the *right* Heller Blade for the job, you're sure of superior cutting every time.

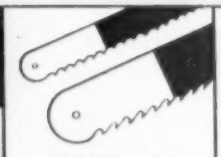
Heller "JOB TEMPERED" Hard Edge Band Saw Blades are available in all tooth shapes . . . Standard Tooth (Regular or Wavy Set), Skip Tooth and Hook Tooth. Saws are available in all standard widths and tooth spacings . . . in 100′ and 250′ coils or welded to specified lengths for use on all type machines.

High Speed Steel Band Saws are also furnished for specific applications.

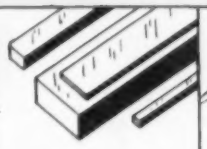




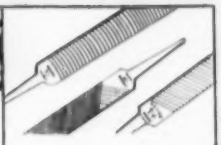
Heller nucut



HACK SAW BLADES



FLAT GROUND DIE STEEL



FAMOUS HELLER FILES

HELLER TOOL CO. Newcomerstown, Ohio

America's oldest file manufacturer

A subsidiary of Simonds Saw and Steel Co.

Give us your toughest band sawing problems

If you've been having trouble, let us show you how the *right* JOB TEMPERED metal cutting band saw can give you better cutting, longer service and greater economy.

Here are the facts!

Heller's new catalog of JOB TEMPERED metal cutting band saws contains full description of types of blades, tooth designs and set. WRITE FOR YOUR COPY TODAY.

SOLD EXCLUSIVELY THROUGH

"YOUR OUTSIDE TOOL ROOM"

Heller Tools

NEW

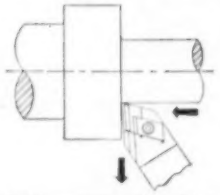
KENDEX PROFILING TOOL

The first "throw-away" insert profiling tool for both roughing and finishing cuts

Here is a new Kennametal Tool, designed specifically for today's contouring machines . . . a profiling tool that incorporates the time-saving, cost-reducing, production-boosting "throw-away" insert feature . . . the first profiling tool with an insert that won't shift . . . *the first profiling tool that can be used for roughing and intermediate cuts, as well as finishing.*

Holders suitable for practically all modern profiling machines are available in three types and 18 sizes. Simplified design provides a rigid assembly, including a hardened alloy-steel shank and clamp. The solid carbide chip breaker plate, indexable insert, and solid carbide insert seat are made of *different grades of Kennametal*—each selected for properties best suited to their particular function.

Inserts are of two general types, right-or left-hand, in four grades. These will handle practically any profiling job. Each insert provides two factory-ground, indexable cutting edges ready for instant use. Each provides a positive rake angle which reduces horsepower requirements and assures more accurate duplication of shapes due to lower tool pressures.



Rigid support and positive clamping holds the insert in position when direction of cutting forces changes as in plunge or "face-out" cuts.

The chip breaker plates of solid Kennametal have exceptional strength and resistance to "pick-up" and so assure continuous chip flow. This clamped plate gives ideal chip control over a wide range of feeds and depths of cut, and eliminates expensive chip breaker grinding.

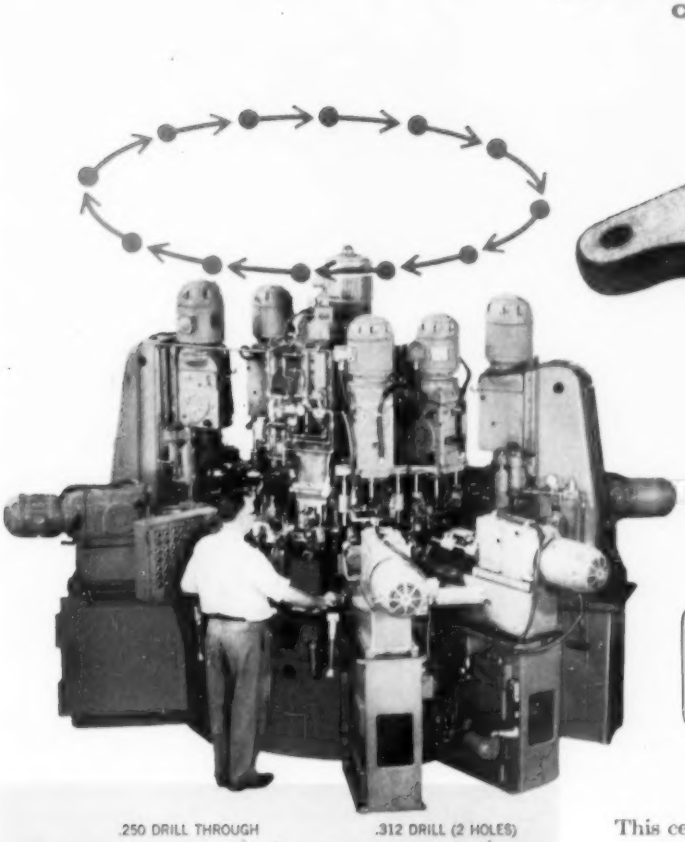
The insert seats, also made of solid Kennametal, have an offset to provide a hard back-up surface that will not "mush out" nor permit the insert to shift under heavy cuts. The seat provides positive insert seating and protects the holder.

For a full description of this important new production tool, write for just-off-the-press Booklet No. B-105. Address: KENNAMETAL INC., Latrobe, Pennsylvania.

C-3050

INDUSTRY AND
KENNAMETAL
. . . Partners in Progress

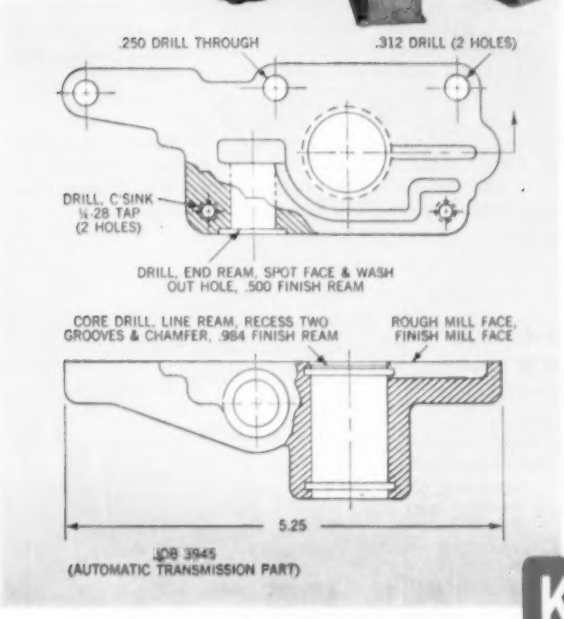
mill
drill
ream
recess
spot face
countersink
tap



200 PARTS PER HOUR GROSS

on this 12-station

KINGSBURY



This central column Kingsbury has 13 units which operate 19 spindles. A loading assembly positions the work (an automatic transmission part) for clamping by an air-actuated mechanism. Two vertical units with adjustable arbors mill the joint face; a recessing unit works on the snap ring grooves. Thirteen tools have guide bushings. Finish reaming is done last, after the heavier operations are completed. Indicator lights signal the operator if any operations are unfinished.

Most Kingsburys are less elaborate. But all have the same purpose:

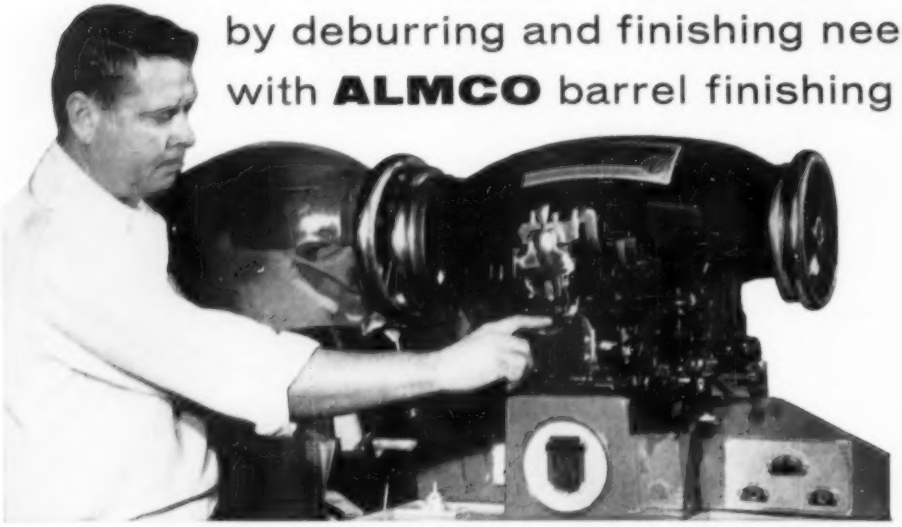
uniform operations
at a high production rate
to the customer's specification
at low unit cost

May we get together on one of your jobs, simple or complex? Kingsbury Machine Tool Corporation, Keene, New Hampshire.

KINGSBURY
INDEXING AUTOMATICS
for high production drilling and tapping

FINISHING ENGINEER AT LANDIS MACHINE CO. REPORTS...

"We cut costs from 55^{00} to 55¢ per 100 by deburring and finishing needle plates with **ALMCO** barrel finishing equipment"



MR. JAMES W. DUNFORD, finishing engineer at Landis Machine Co., St. Louis, points to location of needle plate in new model of Landis shoe repair machine.

BEFORE AFTER

One of the most successful barrel finishing applications on record at Almco is this needle plate deburring and finishing at Landis Machine Company.

The needle plate forgings are drilled and broached and then carefully deburred. Formerly the tough burrs were removed by hand filing at a cost of $55.00 per 100.

Now, an Almco Model DB-200 barrel finishing machine performs the same operation at a cost of 55¢ per 100, a savings of 99%!

MANY LANDIS PARTS NOW BARREL FINISHED

With this $3,200 annual savings on needle plates alone in mind, Landis engineers have applied the Almco method to other parts until the company is now barrel finishing several hundred different parts to high quality standards. Rejects are practically non-existent.

VERSATILE EQUIPMENT

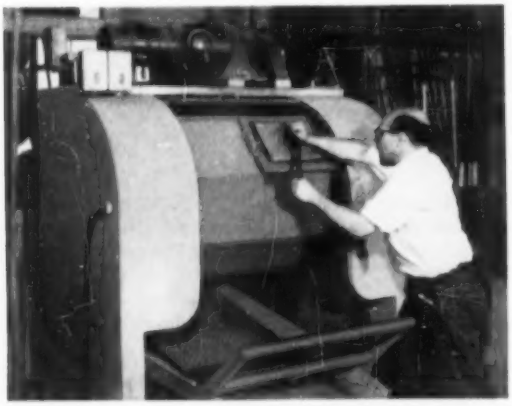
By keeping simple records on processing cycles, correct media and compound, and proper scheduling, Landis engineers can switch the Almco equipment from part to part, to meet plant production requirements exactly.

BROAD EXPERIENCE FOR YOU

Almco's experience in barrel finishing methods and techniques now covers a wide range of parts, sizes, shapes, metals, and operations. Almco maintains sample processing laboratories for the purpose of analyzing product parts and desired results. Let Almco technicians work out procedures to give you the quality you want at the lowest possible finishing cost.

REQUEST YOUR REPORT

Simply write on your company letterhead, requesting an Almco engineer to call on you. Or, send your sample parts and specifications on results direct to Almco. You will receive a detailed report at no obligation.



Finishing department operator at Landis Machine Co. gets ready for parts deburring run in Almco barrel finishing machine. Almco construction is heavy-duty throughout, to stand up under rugged requirements month after month.

SEND FOR THIS NEW BARREL FINISHING HANDBOOK

Complete description of the most advanced modern processes. 52 pages of facts, photos, data and cost comparison charts. Write for your personal copy today.

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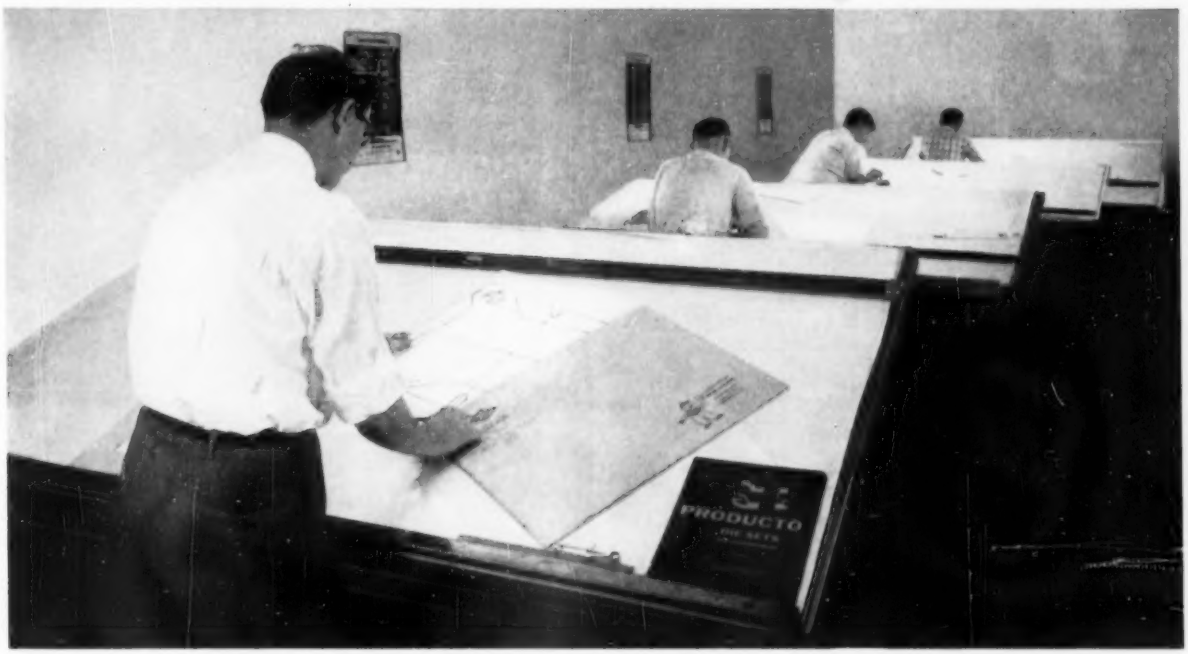
Why the Die Designer Prefers PRODUCTO Die Sets



He can specify Producto with complete confidence

The die designer likes to specify Producto die sets on his blueprints because they are a nationally-accepted "brand." They're easy to get anywhere... and delivery is prompt.

He favors Producto because he knows he never has to compromise his die design. Even if the die layout is a little unusual, he will be able to select a die set to accommodate it from Producto's wide range of thicknesses and styles.

He also knows Producto has the equipment that can cut his tooling costs by letting him adapt his sets to a more economical *basic* design. Only Producto offers him complete foundry, pattern-making, welding and machining services for his special requirements.

The die designer recognizes Producto's Qwik-Fit Guide Pins as an important new feature that die makers want. He specifies them because they save up to 75% of the time normally required for die set assembly and disassembly.

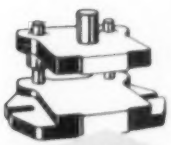
The die designer likes to use Producto's new catalog, the industry's most practical tool. His die layout is simplified when he uses Producto die set templates. And Producto provides him with cost-saving ideas in the DIE SET DIGEST.

Most important, he can depend on *consistent* Producto die set accuracy to transfer from the drawing board to the press the precision and ingenuity of his die design.

Yes, the designer has found that Producto die sets justify his confidence in specifying Producto. You will, too.

TWO FREE AIDS to more economical, efficient use of die sets are available from Producto. All-new CATALOG NO. 11 makes ordering and selection job easy. DIE SET DIGEST gives valuable tips for designers, builders and users of dies. Write for them today.

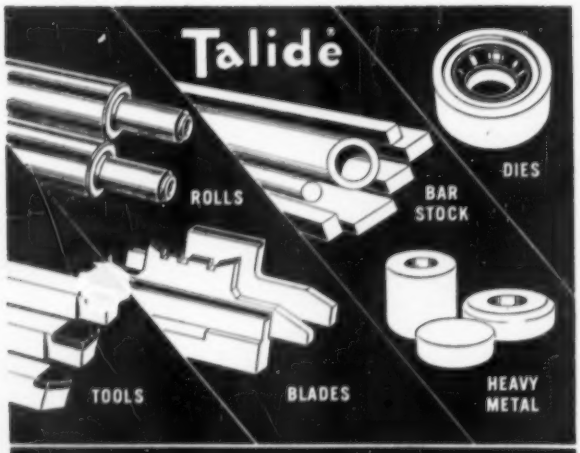
THE PRODUCTO MACHINE COMPANY
930 Housatonic Ave., Bridgeport 1, Connecticut



Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS



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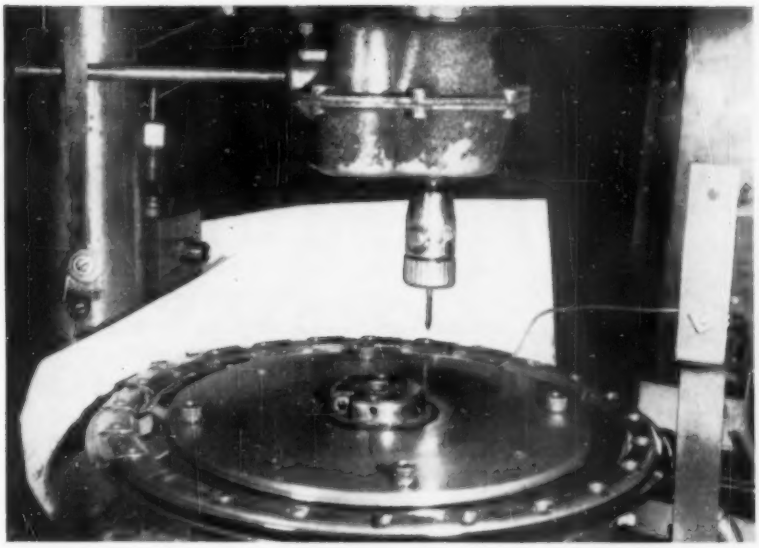


THIS AUTOMATIC MACHINE taps 2900 parts per hour with Besly 8-32 NC Spiral Pointed Machine Screw Taps. An air indexed circular feed table moves parts into position, down comes the tap, up goes the tap and on to the next piece — all automatic except placement and removal of parts.

SMALL PARTS finishing is the business of Keades, Inc. Included are "T"-nuts, bolts, rivets, clips, pins — primarily for the automotive industry. Note Besly 8-32 NC Spiral Pointed Tap right.

BESLY 8-32 NC SPIRAL POINTED TAP . . .

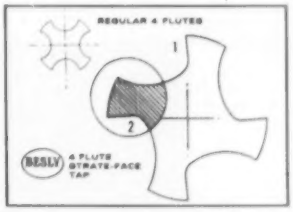
"The Touchstone of Success"

says LEN KEAST of KEADES, Inc.

To increase sub-contract work, Keades, Inc., Wyandotte, Mich., needed a tap to thread small parts in an automatic production machine. Since most taps available failed on the job they called on Besly's Engineering Service for a solution to the problem.

Besly Engineers designed the Besly 8-32 NC Spiral Pointed Machine Screw Tap as the answer. The spiral point on this tap causes it to cut with a shearing action which deflects chips out and ahead of itself. Chips do not accumulate thus eliminating tap lag and breakage. Shallow flutes permit a thicker and stronger tap which gives longer service life. These features, assured Besly Engineers, provide a tap which can operate at higher speeds and less driving power—especially good news to Keades.

Keades now operated two automatic machines, of their own design—shown above, equipped with Besly 8-32 NC Spiral Pointed Taps which thread 2900 pieces per hour at very close tolerances. Each tap lasts 16 hours. This compares to 1500 pieces per hour with taps lasting only 4 hours, by former methods. Savings now amount to $70 per 200,000 parts.



NEW "STRATE FACE" TAP FOR CAST IRON

Designed for freer cutting, more accuracy, longer tap life and less tap breakage. Features — (1) straight cutting face ("Strate Face") has accurately controlled rake angle, (2) new flute and core design with high strength zone makes stronger tap, (3) "Stemite" coating prevents abrasion, stops welding, adds lubricity. Available from No. 6 to ¾" for cast iron tapping only.

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UNBRAKO STRIPPER BOLTS NOW AVAILABLE WITH THE NYLOK* SELF-LOCKING DEVICE

UNBRAKO STRIPPER BOLTS with the Nylok self-locking device. Nylon pellet locks them with positive, dependable prevailing torque action. Bolts are reusable.

SELF-LOCKING UNBRAKO STRIPPER BOLTS fasten this stripper plate securely. Constant vibration, shock, extended running time will not cause these bolts to loosen.

Self-locking UNBRAKO stripper bolts (shoulder screws) save time, money and headaches wherever they are used. They eliminate the costly, time-consuming checking of bolts to see that they are securely tightened. They protect precision tools and dies from damage caused by vibration-loosened bolts. They assure that your equipment will have longer service life, with reduced maintenance and downtime.

UNBRAKO stripper bolts are manufactured to the highest standards of precision. They are made of heat-treated alloy steel with continuous grain flow lines and have fully formed Class 3A threads finished close to the shoulder for maximum strength and holding power. Shoulders, held to fine tolerances, are concentric with heads and threads for uniformly accurate fit. The tough, resilient, *permanent* nylon locking pellet is integral with the threaded section.

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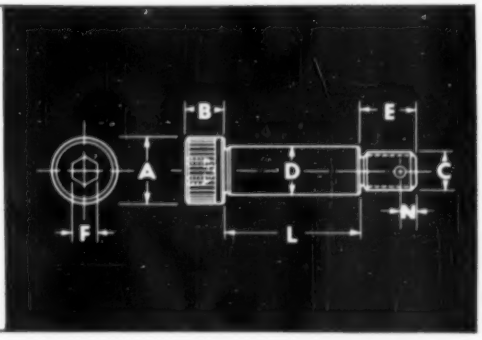
SPECIFICATION DRAWING. UNBRAKO stripper bolts are available with standard shoulder lengths ranging from ⅛ to 6 in.

D	Shoulder Diameter*		¼	5/16	⅜	½	⅝	¾
C	Thread Diameter UNC		10—24	¼—20	5/16—18	⅜—16	½—13	⅝—11
E	Thread Length		⅜	7/16	½	⅝	¾	⅞
A	Head Diameter		⅜	7/16	9/16	¾	⅞	1
B	Head Height		3/16	7/32	¼	5/16	⅜	½
F	Size of Hex. Hole		⅛	5/32	3/16	¼	5/16	⅜
N	Pellet Location		.141	.172	.187	.203	.234	.281
	*Shoulder Diameter Tolerances	Max.	.249	.3115	.374	.499	.624	.749
		Min.	.248	.3105	.373	.498	.623	.748



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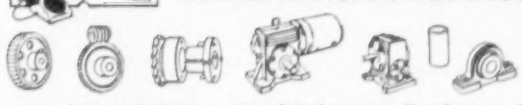

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150 TON

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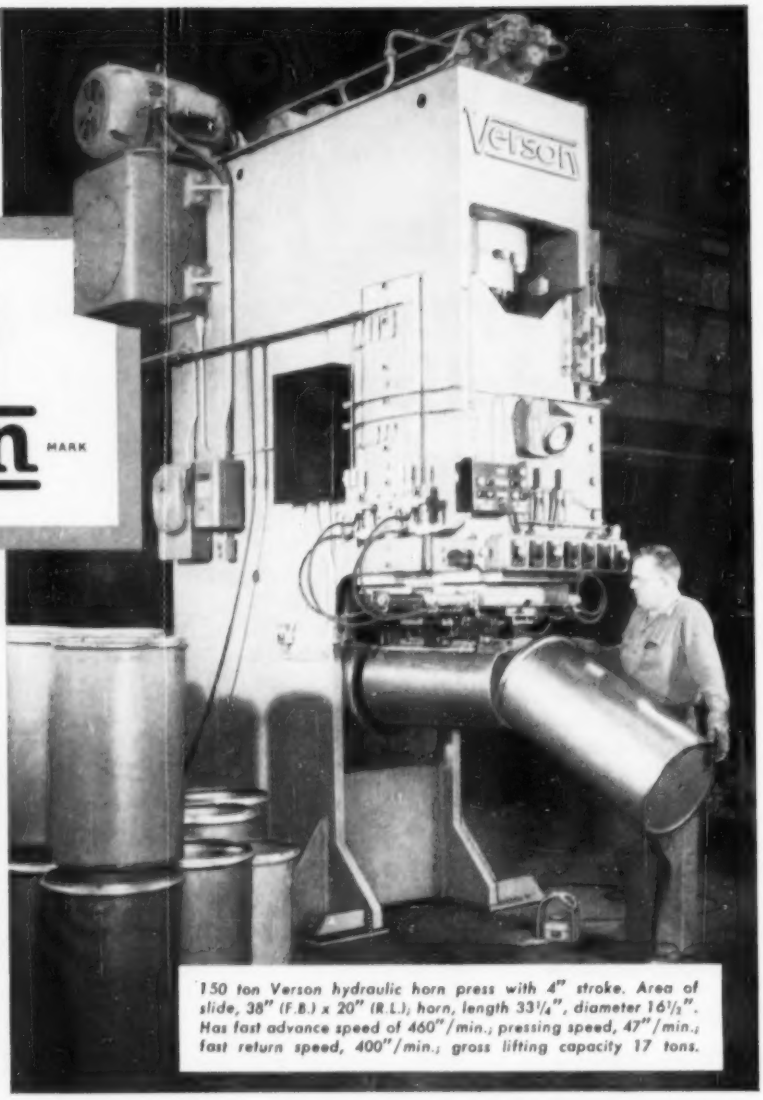
hydraulic HORN PRESS

coins and pierces openings on power line transformer containers



150 ton Verson hydraulic horn press with 4" stroke. Area of slide, 38" (F.B.) x 20" (R.L.); horn, length 33¼", diameter 16½". Has fast advance speed of 460"/min.; pressing speed, 47"/min.; fast return speed, 400"/min.; gross lifting capacity 17 tons.

This 150 ton Verson hydraulic horn press is in use at the Gadsden, Alabama, Works of Allis-Chalmers Manufacturing Company.

The press is employed to automatically coin and pierce 3 different openings, to accommodate various sized leads coming into power line transformer containers. When actuated, the press has a two stroke cycle. A combination coining and piercing die coins the part on the initial stroke—the second stroke is a piercing operation.

The press is equipped with full automatic electrical control and has varying tonnage control for each of the three stations. By preselection, the operator may exert the proper tonnage required to do each specific job.

This hydraulic horn, like all Verson machines, is much more than just a press. It's a production process, engineered and built to provide greater efficiency and production with reduced costs.

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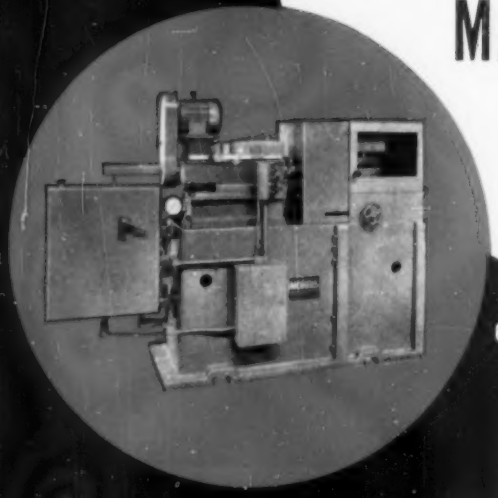

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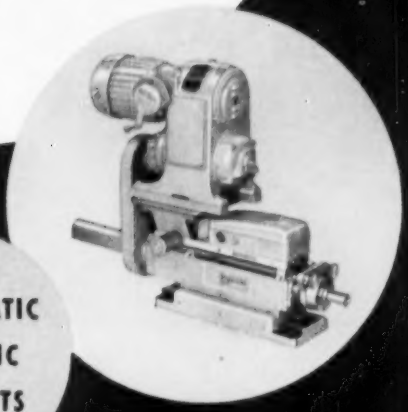

increases efficiency and ease of production for parts like these:

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ALSO
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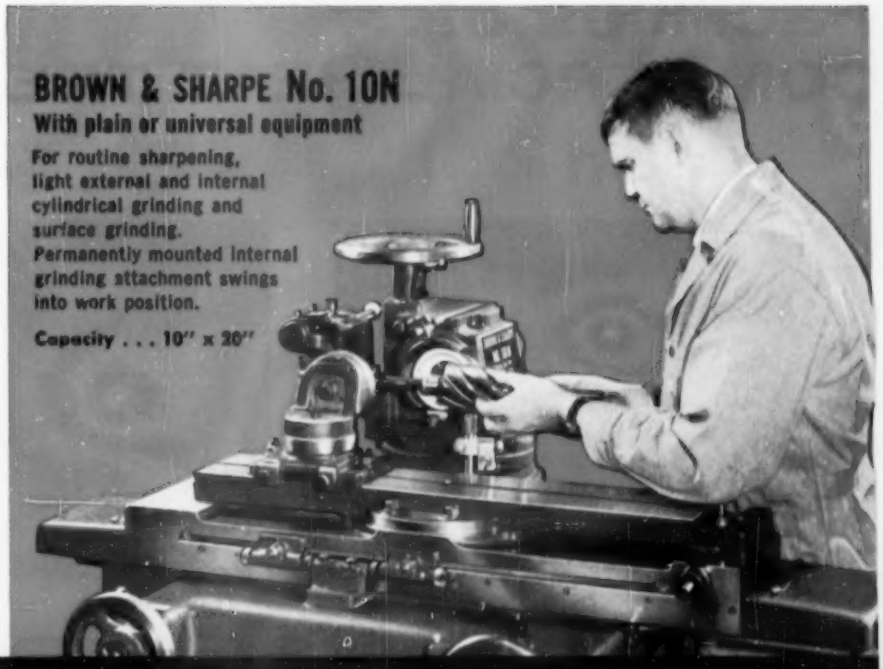
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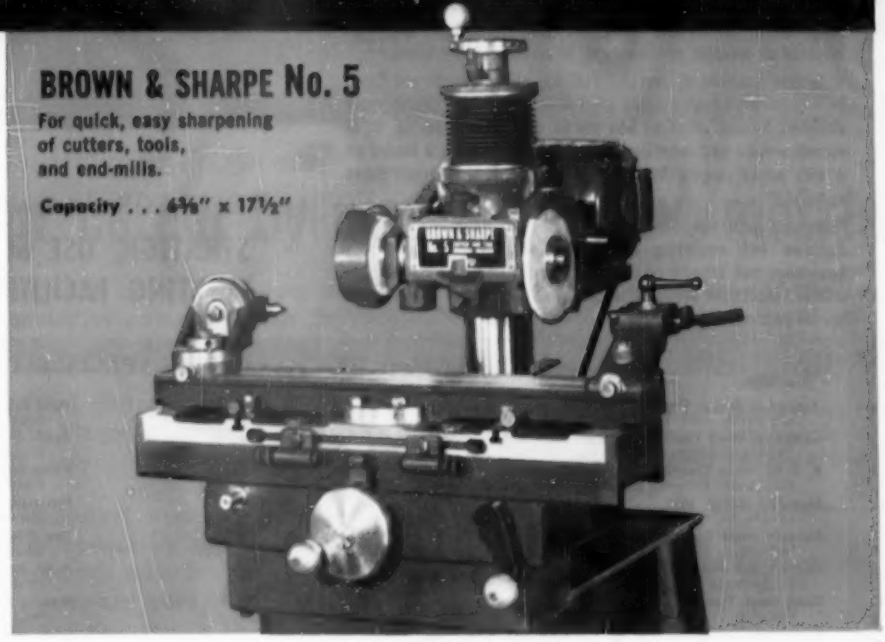

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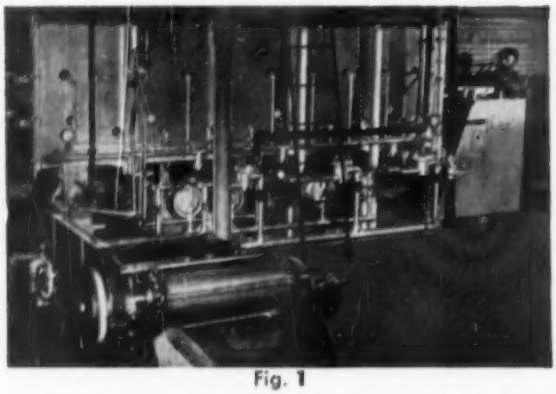

Fig. 1

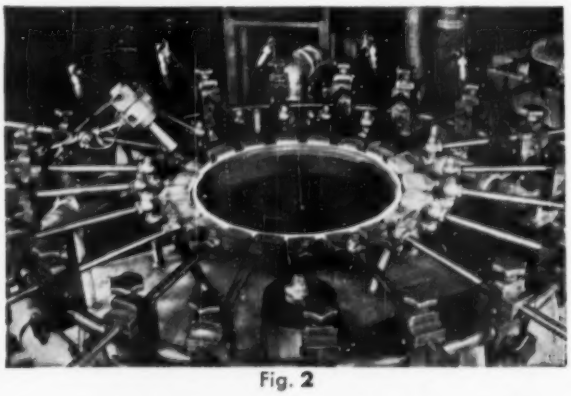

Fig. 2

An MTI commercial heat treater is located near you and is ready to serve your needs by performing "Custom-tailored" heat treating operations.

Because all members of the MTI are specialists with complete service facilities centralized in one plant, they are equipped to offer you a variety of heat treating processes—atmosphere hardening, carburizing, nitriding, annealing, cyaniding, etc.

For example, Fig. 1 shows an installation of a shaker hearth furnace with a continuous automatic quenching tank and a conveyor to a washing machine.

Fig. 2 illustrates a gas flame hardening unit featuring accurate temperature control and using two semi-circular gas manifolds mounted on movable carriages with 20 or more burner heads.

A further example of versatile and dependable equipment found in a commercial heat treating plant is seen in Fig. 3. The specially designed furnace conveyor belt carries over 35 lbs. per sq. ft. in normal service and sometimes as much as 5000 lbs. are loaded on it with pieces ranging from ½ lb. to 100 lbs. and temperatures up to 1650°.

Possessing such equipment together with many other specialized facilities and employing the trained personnel with technical knowledge and experience is the business of the commercial heat treater. Teamwork between you and the commercial heat treater can cut *your* costs.

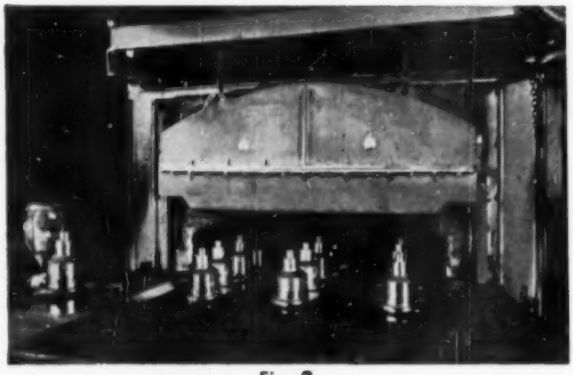

Fig. 3

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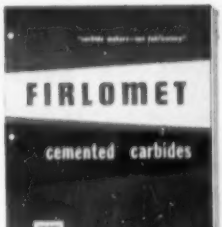

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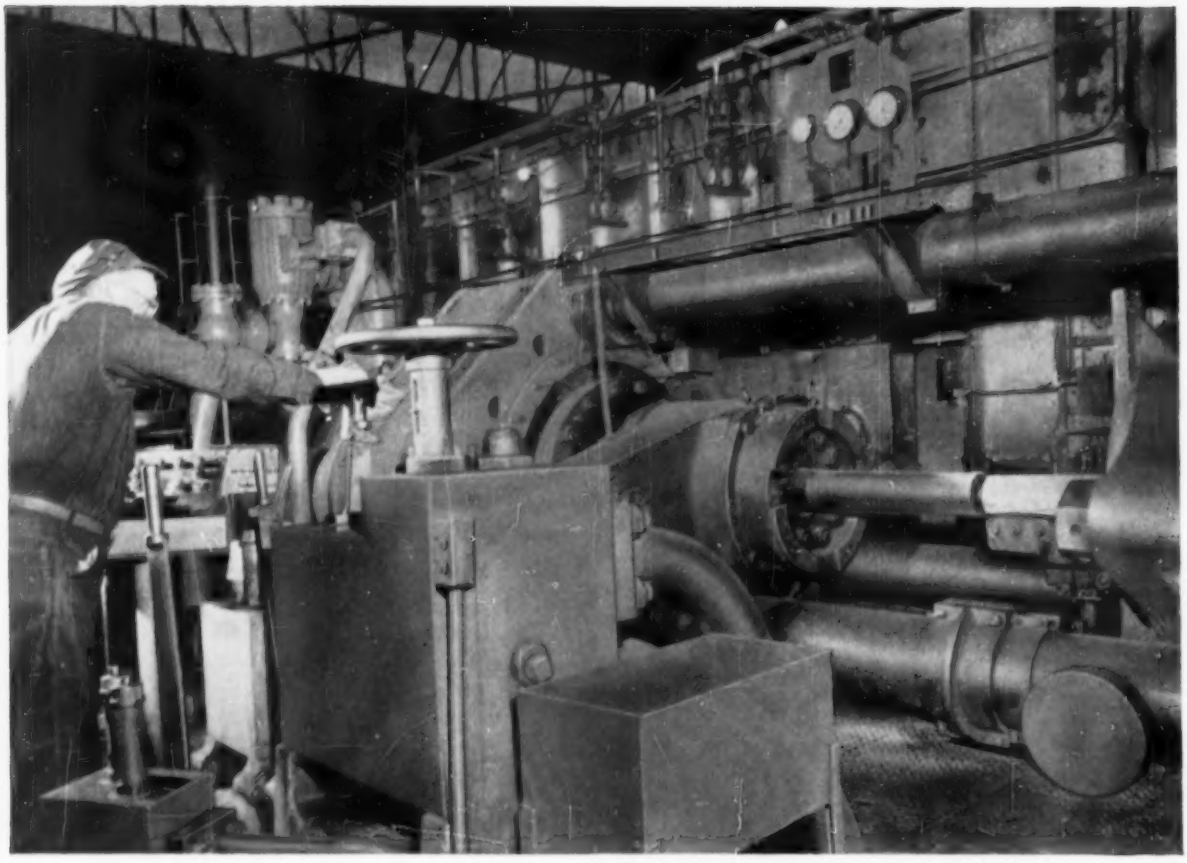

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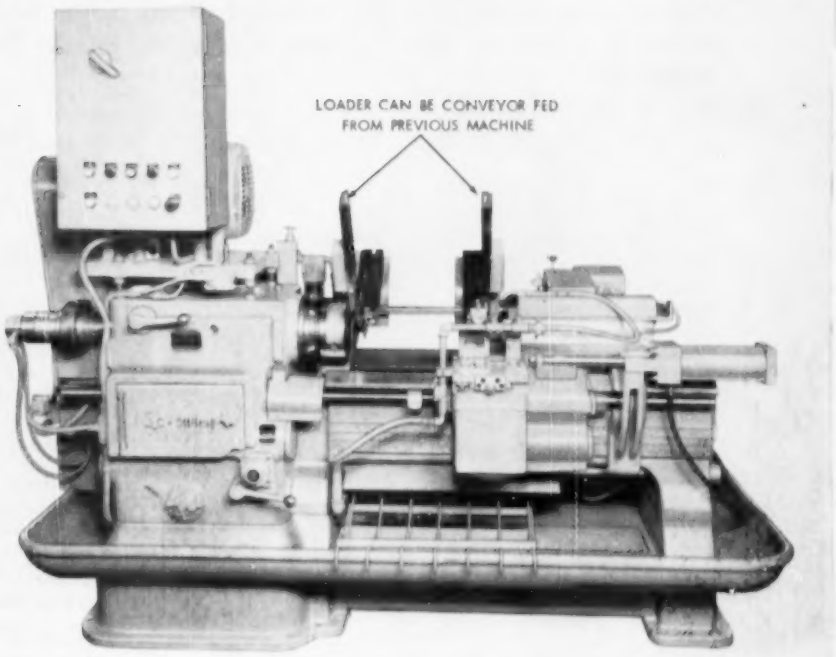

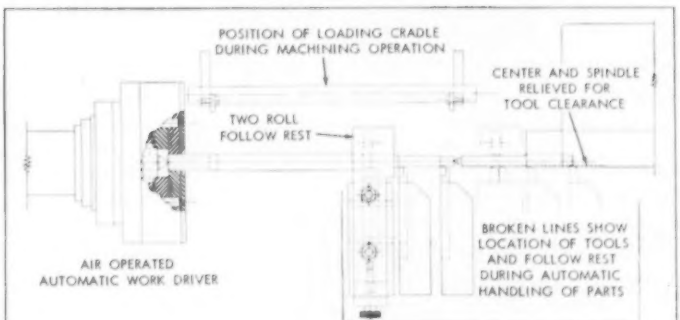

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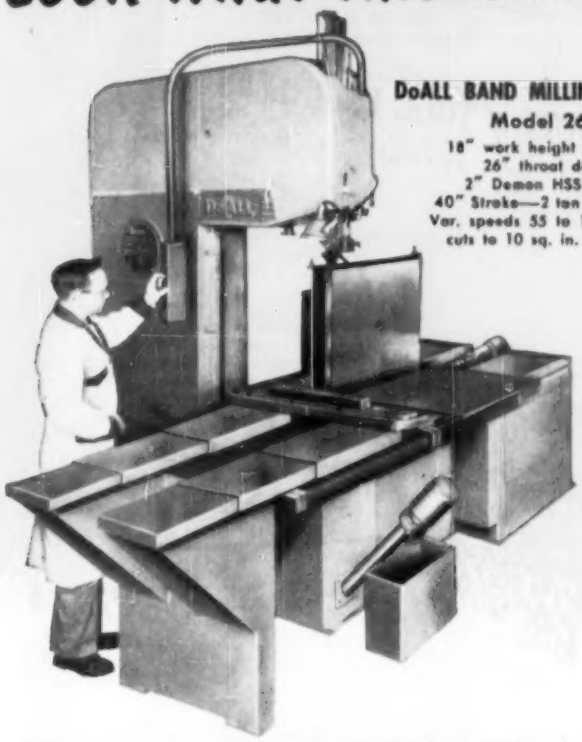

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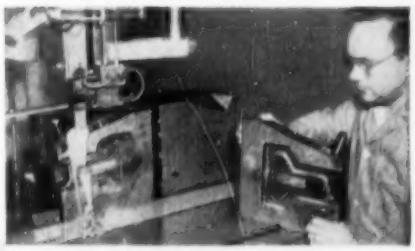

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ASTE membership is not required for submission of a paper. Additional papers will be accepted for consideration until May 1, 1957. Each proposal should include an outline of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

L. S. Fletcher
Program Director
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Detroit 38, Michigan

Authors of accepted papers will be notified by June 15, 1957.

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June 1957 Issue

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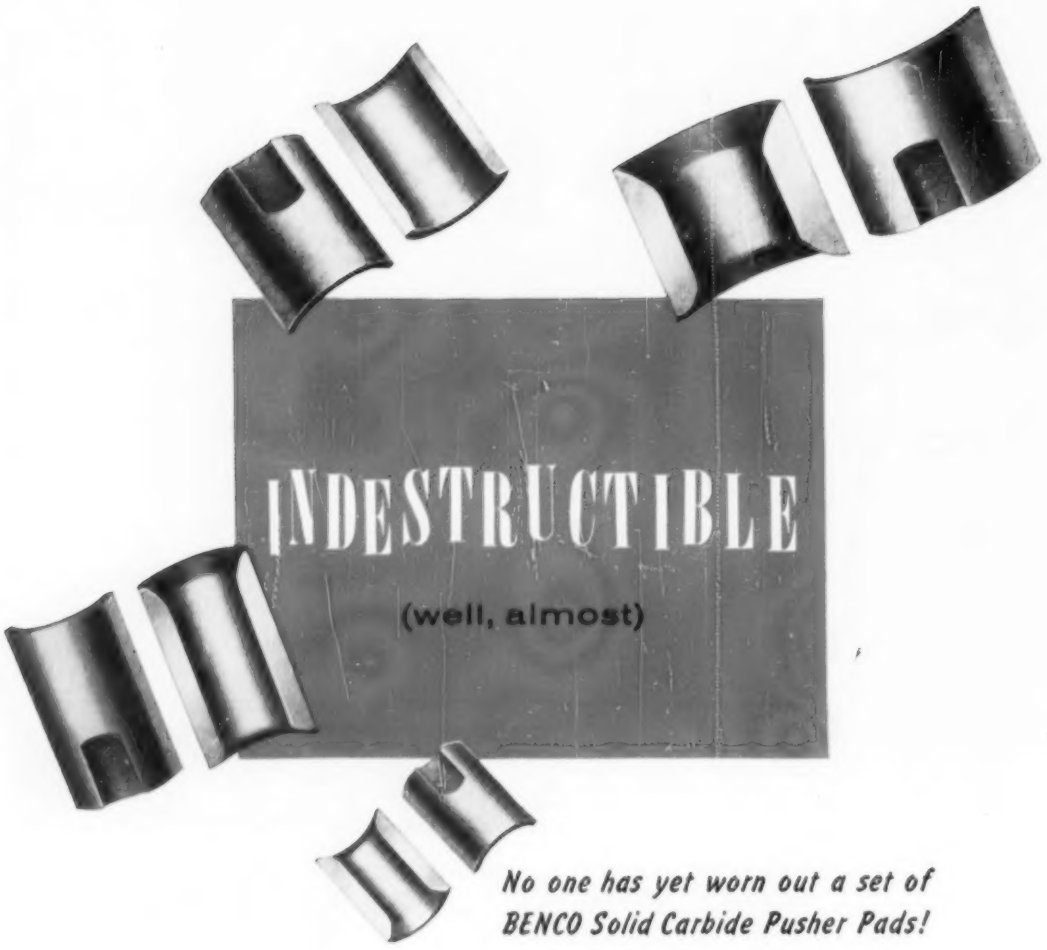

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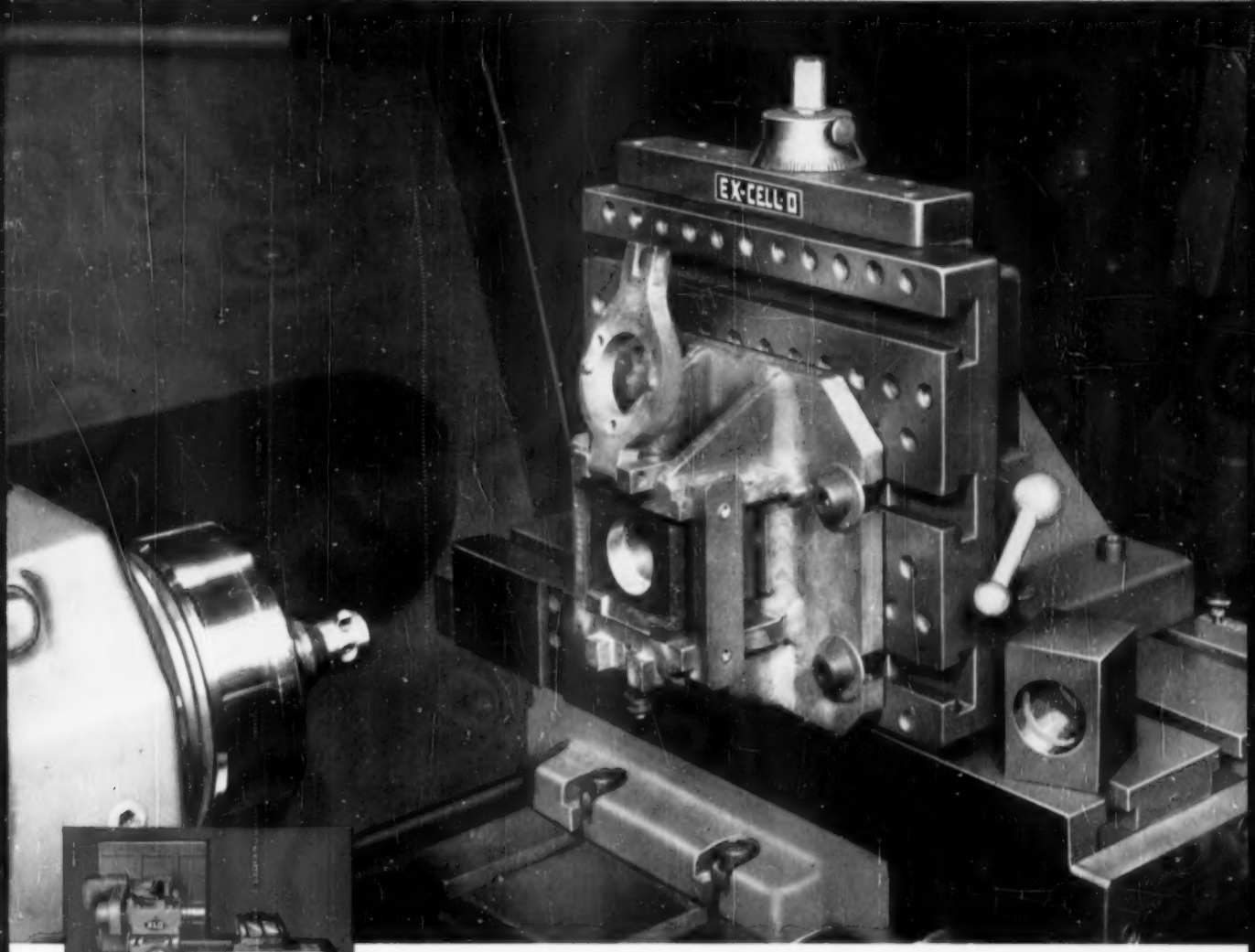
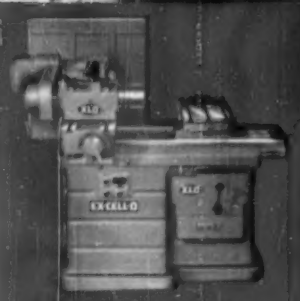


Close-up view of Ex-Cell-O Precision Boring Machine equipped with a single spindle and a universal fixture for small lot production.



2112-S single-end Ex-Cell-O Precision Boring Machine with horizontal cross slide fixture.

1212-S double-end Ex-Cell-O Precision Boring Machine with universal fixture having cross and vertical slides.

These versatile machines keep busy

Ideal machines for toolroom work and short production runs

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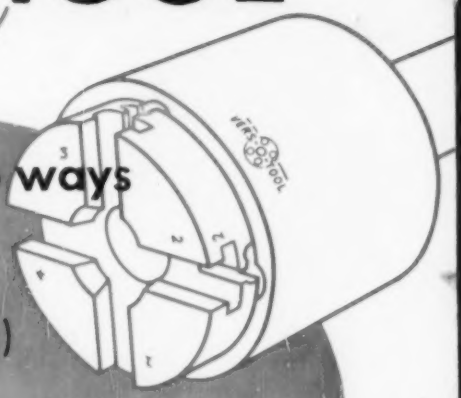
Namco VERS-O-TOOL



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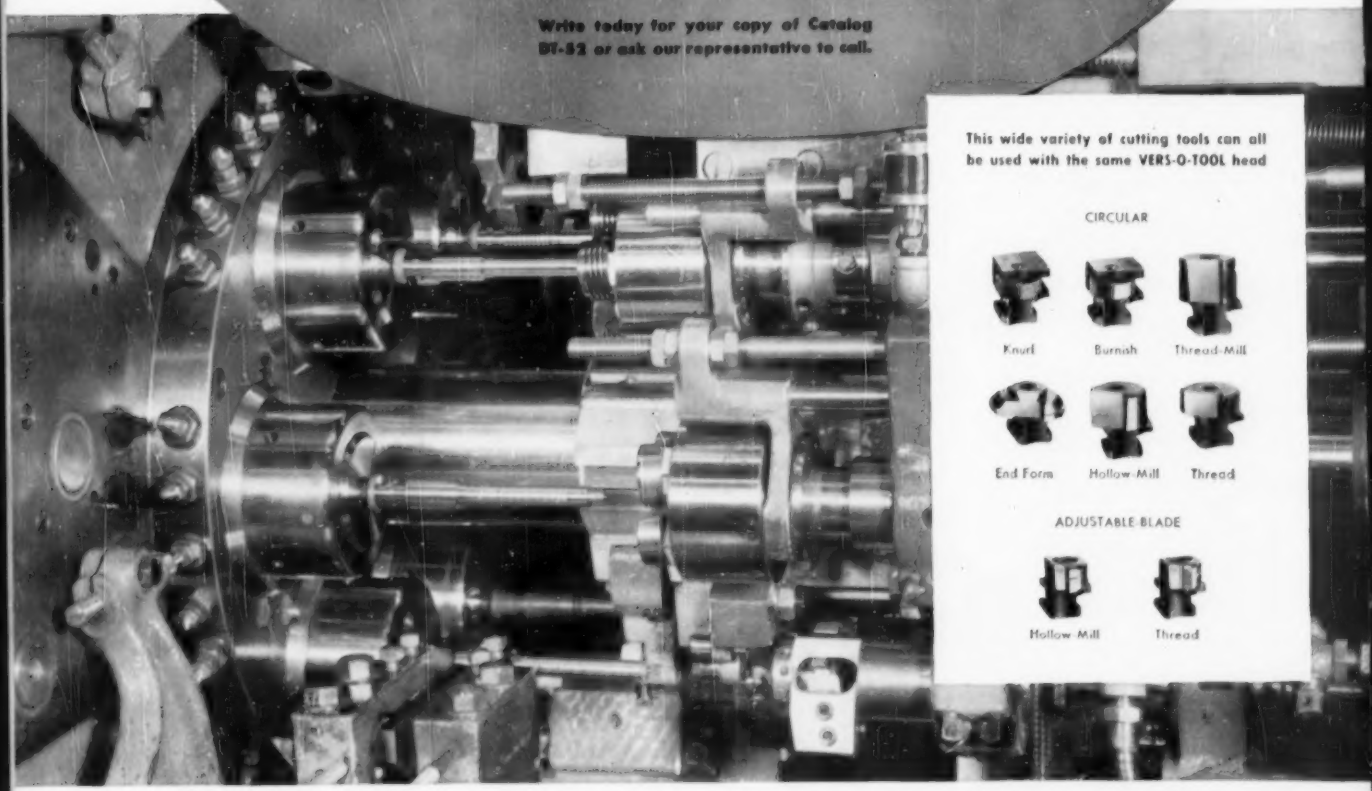

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